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COVER PHOTOGRAPH

The face of this young Rajasthani woman reflects her confidence that life holds more promise than just attending to household chores. Her outlook is hopeful even though India is expected to become the world's most populous country during the next century. India's proposed national population policy to deal with that growth puts emphasis on the reproductive health of individual persons rather than on State-mandated "targets" aimed at achieving "population control". This issue of the *Asia-Pacific Population Journal* considers the country's far-reaching policies, programmes and strategies, and warns that they should remain in line with the recommendations of the Programme of Action adopted at the 1994 International Conference on Population and Development even if their implementation causes a temporary slowing of the on-going fertility decline. (Photograph courtesy of Mr. Marc Proksch)

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Family Welfare Programme and Population Stabilization Strategies in India 3

After tracing the development of the world's oldest family planning programme, the article describes some of the achievements and weaknesses of the related policies and programmes that were in force until the drafting of a new policy during this decade. It concludes with a number of recommendations that if implemented would make the programme sustainable over the long term.

Reproductive Preferences in Matlab, Bangladesh: Levels, Motivation and Differentials 25

This article examines whether reproductive preferences and the motivation behind the preferences are similar in two areas of Bangladesh; it also attempts to determine whether reproductive preferences vary by socio-demographic subgroups. In both areas, mean desired family size was found to be slightly over three children and women said that they preferred to have two sons. Also, it found that the economic cost of children and knowledge of family planning were mainly responsible for the small family-size desire. The article draws out a number of implications for policy and programme purposes.

Women's Education and Employment: Matlab Experience 45

This study attempts to assess women's educational impact on their employment activities and some other selected background characteristics. For this, the BRAC-ICDDR,B baseline survey data set, which was collected in 1992, was used in the analysis. The bivariate analysis demonstrated clearly the relative importance of education, which was positive and significant, on such characteristics as contraceptive use, number of living children, amount of savings and loans, hygiene practice and employment activity. The multivariate logit analysis revealed that generally a woman was more likely to be engaged in wage-earning activity if she had some level of education; the higher the level, the more likely that she would be employed. It also found that women's employment is closely related to their savings. The baseline results suggest that BRAC's socio-economic intervention of education and credit to Matlab people would be able to effect favourably their lives.

Family Welfare Programme and Population Stabilization Strategies in India

The programme certainly needs to be focused at achieving various welfare-oriented targets rather than increasing the number of contraceptive acceptors

By Arvind V. Zodgekar*

India's population in 1996 is estimated to be 952.3 million, making it the second most populous country in the world (ESCAP, 1996). The implicit annual growth rate during the 1980s was 2.1 per cent, only slightly lower than the 2.2 per cent observed during the period 1961-1981 (see table 1 for additional rates and more recent data). With the current rate of growth, India's population is expected to cross the one billion mark by the year 2000. India is likely to replace China as the world's most populous country some time before the middle of the twenty-first century.

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Table 1: Selected demographic indicators: India, major States and capital

States/areas	Population	Growth rate	Crude birth rate	Crude Death rate	Total fertility rate	
	1991 census (millions)	1981-1991 (per cent)	1993* (per thousand)	1993* (per thousand)	1970–1972	1990–1992
Andhra Pradesh	66.5	23.8	24.1	8.4	4.7	3.0
Assam	22.4	23.6	29.5	10.2	5.5	3.4
Bihar	86.4	23.5	32.1	10.6	–	4.6
Delhi (Union Territory)	9.4	53.0	21.8	4.1	–	–
Gujarat	41.3	20.8	28.0	8.1	5.7	3.2
Haryana	16.5	26.3	30.6	7.8	6.4	3.9
Himachal Pradesh	5.2	19.4	26.7	8.6	4.7	3.1
Jammu and Kashmir	7.7	28.9	–	–	4.8	3.3
Karnataka	45.0	20.7	25.5	8.0	4.4	3.1
Kerala	29.1	14.0	17.3	6.0	4.1	1.8
Madhya Pradesh	66.2	26.8	33.4	12.6	5.7	4.6
Maharashtra	78.9	25.4	25.0	7.2	4.5	3.0
Orissa	31.7	19.5	27.2	12.2	5.3	3.3
Punjab	20.3	20.3	26.3	7.9	5.3	3.1
Rajasthan	44.0	28.1	33.6	9.0	6.3	4.5
Tamil Nadu	55.9	14.9	19.2	8.0	3.9	2.2
Uttar Pradesh	139.1	25.2	36.0	11.4	6.7	5.2
West Bengal	68.1	24.6	25.6	7.3	–	3.2
India (as a whole)	**846.3**	**23.5**	**28.5**	**9.2**	**5.2**	**3.7**

Sources: Office of the Registrar General, *Sample Registration System Fertility and Mortality Indicators 1991* (New Delhi: Government of India, 1993). Central Statistical Organization, *Selected Socio-Economic Statistics for India*, Ministry of Planning and Programme Implementation (New Delhi: Government of India, 1995).

Note: * Provisional.

How did it get to this point? It did not happen overnight. Soon after independence in 1947, the size and growth rate of the population were recognized as potential problems. Thus, from the early days a family planning programme was envisaged as an integral part of a comprehensive social development programme. India was the first independent country in the world to adopt a policy of reducing population growth through a government-sponsored national family planning programme, as called for in the First Five-Year Plan (1951-1956). India officially began to implement that programme in 1952. Since then the programme has undergone various changes in order to influence the reproductive behaviour of the population and increase the number of acceptors of various family planning methods. However, in spite of a long series of officially run family planning

programmes during the ensuing decades, the pace of fertility decline has been relatively slow. This raises the question of whether the focus, priorities and responsibility of the family planning programme should remain the same in the future.

The reasons for the achievements and limitations of the programme are many and complex and are not without prejudice and cryptic assertions. Thus, the central issues in this discussion should be (a) a review of the basic philosophy of the family welfare programme, (b) consideration of whether the programme alone could change couples' fertility behaviour sufficiently and firmly establish a small family norm and (c) assessment of the role of development and population-influencing factors such as literacy, status of women and infant mortality, among others. Therefore, this article presents a set of observations and propositions for exploration and discussion.

Population stabilization strategies

Although the First Five-Year Plan acknowledged the serious economic consequences of high fertility, the need for birth control was presented primarily in terms of concern for the health and welfare of families and their individual members. At that time planners in India had good reason to proceed cautiously in inaugurating a population policy aimed at reducing fertility, because virtually nothing was known about the attitudes of the masses or the views of religious and other leaders. Nevertheless the declared goal was a reduction in the birth rate to the extent necessary to stabilize the population at a level consistent with the requirements of the national economy.

The policy focus from the beginning has been on the limitation of family size. The principal means of implementing the policy has been the propagation of the family planning programme. The programme was directed primarily at building up a large infrastructure for providing family planning advice and services and creating public opinion actively in favour of the programme. Successive five-year Plans have repeatedly stressed these objectives and approaches. The preoccupation with fertility control in every five-year Plan was translated essentially into efforts to reduce the birth rate. This objective was further highlighted from 1966-1967 onwards, when the programme to reduce the birth rate was made target oriented. This was largely the result of pressure from neo-Malthusian thinkers about the need for population control. It was argued that, without a major improvement in the adoption of family planning, national development goals would be extremely difficult to realize. A rapid decline in both the birth rate and the

population growth rate was considered to be of utmost importance. Unless a sense of national urgency could be introduced in the form of compulsive persuasion in that direction, an effective decline in the birth rate would take too long to foster if it were to be solely a consequence of economic and social development. This view prompted the central Government to announce a detailed population policy introducing a number of new measures.

The introduction of a compulsory element in the family planning programme probably had a certain appeal since it would seem to offer a means for fulfiling the goal of lowering the birth rate. But was it the only way to achieve a reduction? One view preferred to emphasize general socio-economic development as the means for bringing about fertility decline, as was the experience of the now more developed countries of the world. Another view placed strong hope in the role to be played by the family planning programme. Although it is generally believed that development activities and family planning programmes are "mutually reinforcing complements" rather than "mutually exclusive", the Health Minister's policy statement of April 1976 stated, among other things, that "to wait for education and economic development to bring about a drop in fertility is not a practical solution". The rationale behind this statement could have been that India could not afford to wait for 15-20 years for general overall socio-economic development to take place in the hope that it might ultimately generate a movement towards curtailing reproduction. It is also true that, in the light of the rapid growth of population, overall socio-economic development is difficult to achieve and is not guaranteed. This does not mean that the planners and policy makers had completely ignored the permanent and lasting effects of socio-economic development on fertility attitudes. What probably had been envisaged was that limited strong measures towards curtailing fertility would be essential while general socio-economic development was taking place.

Official pronouncements and actions by the central Government indicated that it hoped to limit India's population growth through a certain degree of gentle and civilized pressure, persuasion and compulsion. It was commonly believed that, while a certain degree of control could be achieved through such measures, efforts should proceed concurrently for achieving general socio-economic development so that the two efforts could synergize each other and result in a substantial and permanent decline in fertility.

Subsequent experience has shown that this never happened – largely because target setting and target fulfilment became entrenched within the official establishment, and maintenance of the status quo was sought on the

basis that, if targets were removed, the programme would collapse (Bose, 1989:179). The 1985-1990 declared strategy emphasized, among many other things, the need to generate an environment for fertility decline through relevant socio-economic intervention. Although, at times, "attempts have been made to enlarge the definition of family planning by interpreting it as family welfare or qualitative improvement of the life of the people, the hard fact is that it has been, and still is, largely, a programme of fertility control" (Panadikar, 1981:4).

India's Eighth Plan recognizes the population challenge as one of six priority objectives for concerted and cohesive intervention; more importantly, all six of them relate to the social sector. However, in terms of implementation, the Plan still refers to demographic targets, such as reduction of the birth rate to specific levels. It does not spell out the actual implementation of the specific activities to speed the population-influencing policies and the social change through socio-economic development. Such a situation often gives the impression that declared policies and commitments are mere rhetoric, particularly in the area of social policies in the population policy package.

Family welfare programme: achievements and limitations

In India, as in many developing countries, the family planning programme is the most direct public policy measure initiated to reduce the population growth rate. Since the formal beginning of the programme in the early 1950s, it has gone through many structural, administrative and implementation strategy changes. All those changes will not be described here; instead focus will be on only critical areas of programme activity and their impact on achievements and their limitations. There is no doubt that the facilities and services made available for family planning have increased substantially over time. In the rural areas, at the beginning of April 1991 there were 130,978 sub-centres, 22,059 primary health centres, and 1,923 community health centres (Department of Family Welfare, 1990/91:257-263). The above statistics are just one of the indicators which show that the programme has certainly succeeded in establishing a very good infrastructure through which family planning facilities and services have increased over time. However, there are some doubts about the full utilization of these services and the quality of service standards being provided by these centres (Singh, 1989:39).

The programme has contributed to large-scale awareness about family planning, contraceptives and available facilities (Mahadevan and others, 1989). There are reports of an increasing number of sterilization operations,

Table 2: Couples effectively protected in major India States by various methods of family planning, 1991

States/areas	Percentage of couples effectively protected due to:			All methods	Percentage accounted for by sterilization
	Sterilization	IUD	Other		
Andhra Pradesh	33.6	3.6	5.0	44.3	75.8
Assam	25.8	1.6	0.9	28.2	91.5
Bihar	22.3	2.9	0.8	26.0	85.8
Delhi (Union Territory)	21.1	9.1	10.2	40.4	52.2
Gujarat	39.3	11.0	7.5	57.8	68.0
Haryana	32.8	12.7	11.1	56.6	58.0
Himachal Pradesh	37.5	8.7	5.8	52.1	72.0
Jammu and Kashmir	17.8	2.5	0.8	21.1	84.4
Karnataka	38.8	5.4	2.6	46.9	82.7
Kerala	45.8	5.2	4.6	55.6	80.9
Madhya Pradesh	27.1	5.3	7.8	40.3	67.2
Maharashtra	42.1	6.7	7.4	56.2	74.9
Orissa	31.3	5.6	4.1	41.0	76.0
Punjab	41.1	24.3	10.4	75.8	54.2
Rajasthan	21.9	4.4	2.7	29.0	75.5
Tamil Nadu	45.0	8.8	3.5	57.3	78.5
Uttar Pradesh	19.9	11.4	4.2	35.5	56.1
West Bengal	29.1	2.2	2.4	33.7	86.3
India (as a whole)	**30.3**	**6.7**	**7.2**	**44.1**	**68.7**

Source: Department of Family Welfare, "Family welfare programme", In: *India Year Book* (New Delhi, 1990-1991).

IUD insertions and use of other contraceptive methods (Raina, 1994:172), all of which have increased the couple protection rate. According to Department of Family Planning statistics, the percentage of couples effectively protected increased from 10.4 per cent in 1971 to 44.1 per cent in 1991 (tables 2 and 3) (Department of Family Welfare, 1990-1991).

Since the goal of the family planning programme has always been established in terms of demographic targets, it is logical that its performance would have to be evaluated in terms of its impact on the reduction of the birth rate. The various fertility indicators certainly do show some trends towards declining fertility in India. The crude birth rate seems to have declined from about 45 per thousand in the 1950s to 28.5 per thousand in 1993. The total fertility rate has also declined from about 5.2 children per woman (1970-72) to 3.7 (1990-92). This amounts to a nearly 28 per cent decline in fertility during the period 1970-1990. A number of other demographers (Jain and Adlakha, 1982; Rele, 1987; Visaria and Visaria, 1994) also reported a reduction in fertility during the last few decades.

Table 3: Number of couples effectively protected by various family planning methods, selected years from 1970 to 1991

Period	Eligible couples (thousands)	Couples effectively protected due to:			All methods
		Sterilization	IUD	Other	
1970-71	94,489	7,584	1,288	1,963	9,853
		(8.0)	(1.4)	(2.1)	(10.4)
1975-76	105,239	14,692	1,101	3,528	17,843
		(14.2)	(1.0)	(3.4)	(17.0)
1980-81	116,033	23,321	1,173	3,809	26,444
		(20.1)	(1.1)	(3.3)	(22.8)
1985-86	129,432	34,312	4,800	10,744	45,163
		(26.5)	(3.7)	(8.3)	(34.9)
1990-91	145,140	43,497	9,664	17,814	64,071
		(30.3)	(6.7)	(12.3)	(44.1)

Source: Department of Family Welfare, "Family welfare programme", In: *India Year Book* (New Delhi, 1990-1991).

Note: Figures in parentheses are percentages.

Questions have been raised whether the decline has been sufficiently large to merit applause for the efforts of the family planning programme. It is our view that birth rates and total fertility rates are still too high. Also, the pace of the fertility decline is slowing; it almost came to halt in the 1980s (Jain, 1989:2729; Raina, 1994:197).

Another aspect of the programme which needs to be evaluated concerns the number of acceptors of family planning and their demographic characteristics. Even though the couple protection rate has increased from 10.4 per cent in 1971 to 44.1 per cent in 1991, most of this increase has been achieved through sterilization alone. In 1991 nearly 69 per cent of the total couple protection rate was accounted for by sterilization (table 2). Also, there has been some inconsistency between the couple protection rates and total fertility rates observed among various States. This raises a question concerning the accuracy of reporting the non-reversible methods used and the efficiency with which they have been used. The demographic characteristics of the the couples concerned also are not very conducive to a steep decline in fertility. The mean age of acceptors is above 31 years. These couples on average have at least 3.3 living children (table 4). This profile has hardly changed over the years. This means that the programme has not been very successful in recruiting younger couples with lower parity. It also has not been able to popularize the use of reversible methods.

Table 4: Demographic characteristics of acceptors of vasectomy, tubectomy and IUD, selected years from 1977 to 1988

	1977-1978	1982-1983	1987-1988
Vasectomy			
Mean age of wife (years)	31.5	31.1	32.4
Average number of living children	3.1	3.4	3.6
Tubectomy			
Mean age (years)	30.1	30.5	30.2
Average number of living children	3.5	3.7	3.3
IUD			
Mean age (years)	28.1	27.7	27.4
Average number of living children	2.6	2.5	2.3

Source: Department of Family Welfare, *Demographic Profile of Family Planning Acceptors (1987-88)*, Ministry of Health and Family Welfare (Government of India, 1990).

The question is whether the continued emphasis on terminal methods (particularly sterilization), users of which are mostly at older ages and higher parity, will be able to bring about replacement-level fertility in the near or even distant future. The total fertility rate for 1990-1991 has been estimated to be on the order of 4.3. The age pattern of fertility in rural India at this level of total fertility implies that women, on average, have three children by the time they are 30 years of age. The age pattern of sterilized women suggests that the family planning programme by now has captured most of the demand for sterilization. Unless a demand is created for terminating childbearing at younger ages and lower parity, a further decline in fertility is unlikely to take place. Jain (1989) has clearly demonstrated through the application of a simulation model that, if the current pattern of contraceptive mix were to continue, a very high percentage of couples under age 30 using sterilization would be needed in order for the country to reach replacement-level fertility. This is unlikely to happen under the conditions of relatively high infant and child mortality currently prevalent in India. Couples under the age of 30 years are most likely to use temporary methods of contraception for birth-spacing rather than to stop childbearing permanently. It is essential to net "high-risk" couples in order to ensure the future success of the programme. Such couples naturally will be young and of lower parity. Because they would not be suitable candidates to recruit for sterilization, attention certainly must be given to the need for expanding the use of reversible methods.

One can safely say that, although some progress has been made, it has not been enough. This raises the question of whether family planning has affected human reproductive behaviour to the extent of being able to

promote the ideal of a small family size. In light of this we need to look at certain aspects of the programme, both in terms of its philosophy and implementation strategies of the past.

It is also appropriate to look at the recent proposed changes to India's population policy. The proposed population policy (draft document, as it is called) emphasizes that the policy needs to be tailored to suit the particular socio-cultural and socio-economic factors prevailing in each area of the country. Such a shift in approach is fundamental to achieving a population policy driven by people's perceived needs. It proposes that the current target-oriented approach of a centrally sponsored/vertical programme be replaced by a people-oriented, decentralized approach. The principle of integration and decentralization in this proposed policy document also calls for a restructuring of the Ministry of Health and Family Welfare (Expert Group on Population Policy, 1994:27). The proposed policy argues that there is a need for a structure which has the requisite authority, autonomy and accountability to make this happen. Under the new structure, the establishment of a Population and Social Development Commission is proposed. The commission's responsibilities would include formulation and implementation of population policies and strategies. It is argued in the proposed policy document that the setting up of such a commission supported by a "population and development fund" would enable the governmental and non-governmental organizations concerned to have the means, flexibility, will and enthusiasm to achieve national goals. Based on this, it is necessary to address those issues which will increase the effectiveness of the programme in the future.

Role of the target approach

Target setting became the main feature of the Indian family planning programme from the mid-1960s (see Raina, 1988). Bose (1987) has also provided a good discussion on the implications of family planning targets. He came to the conclusion that target setting was merely a routine approach to streamline the programme. Unfortunately, over the years, the target has become an end in itself and not the means to bring about a decline in the birth rate (Bose, 1989:186). In order to fulfil targets, it was inevitable that a great deal of drafting and mobilization of personnel from other "nation-building" activities would be required for the sake of the family planning programme. However, these personnel were not equipped to deal with such sensitive areas as those related to individual family life. So the kind of persuasion and pressure applied by these people was very crude, lacking the human touch.

The problem was further compounded by the incentives and sanctions offered by State Governments to their staff for fulfiling quotas. This resulted in over-reporting performance and a tendency to pressurize the people, which at times resulted in unethical practices. Total preoccupation of field staff with target fulfilment also resulted in the neglect of motivational and other necessary functions. Thus, the negative family planning programme image created through the target approach needs to be changed.

Does this mean that targets should be totally abolished and, along with them, the role of terminal methods de-emphasized? The answer is no. Rather than phobia, a redefinition is needed in terms of what is realistic and feasible. Terminal methods (sterilization) need to be continued as part of the family planning programme. This is largely because a significant proportion of the rural and some urban sections of the population are illiterate and have inadequate means for practising other conventional methods of contraception. It seems that terminal methods will remain best suited for this section of the population for some time to come. Advocacy for and popularization of sterilization should remain as one of the targets of the programme. However, this aspect of the programme should not be converted into a "numbers game". Any incentive in the form of compensation money (for the loss of wages etc.) should be retained but it should not be promoted in such a way that it appears to be a bribe. Moreover, motivators and workers should not be given incentives. The role of incentives and disincentives should be addressed in a more rational manner with respect to their effectiveness for promoting the acceptance of the small family norm. Couples with two or fewer children should be given higher incentives.

There is a need to introduce other forms of target-oriented goals for programme workers. For example, each worker should be encouraged to maintain a register of eligible couples and their children, keeping it complete and up to date so as to assist them to set their own programme norms. Thus, they would be able to adopt a needs-based approach to motivate couples to accept family planning welfare services rather than strain themselves to attain unachievable targets (Sawhney and others, 1989:2). In other words, the programme needs to be focused at achieving some welfare-oriented targets rather than a certain number of contraceptive acceptors (particularly those of sterilization).

Decentralization

The family planning programme has been accepted since its beginning as an integral part of the planning process in India. The pattern of funding and the working strategy adopted under the programme has resulted in

centralized planning and centralized decision-making. The family planning programme had traditionally delivered the "same packages" to all areas of the country. A major shortcoming of this approach was its failure to recognize that, in a diverse and pluralistic society such as India, it is seldom possible to build consensus quickly and to organize effective support for implementing nationwide programmes. Among the developing countries, India presents a unique case in terms of the sheer number of people involved and the extreme heterogeneity of its cultures, languages and socio-economic conditions. An important lesson to be learned from past failures is that the family planning programme in India must be planned in the context of the country's diversity. Hence, there is a need to achieve greater decentralization, both in planning and implementation. To improve the effectiveness of the family planning programme, it must be decentralized to reach the grass-roots level (Gandhi, 1989).

The Eighth Plan envisages the need for people's participation and a community-based system. The Expert Group on National Population Policy in its draft policy states:

> "Policies and programmes will have to be tailored to suit the particular socio-cultural and socio-economic factors prevailing in each area. The year 1994 provides an excellent opportunity for promoting the concept of unity in national population goal but diversity in implementation strategies. With the Panchayat Raj Act coming into force in all States and Union Territories, there is a real opportunity for planning at grassroots level". (1994:3)

Based on the national population policy framework, each *panchayat* (village council, or local administrative unit) or similar local government body can be encouraged to prepare a socio-demographic profile and develop a plan of action for achieving population stabilization. The benefit of such an approach is that programme decision-making would be brought into direct contact with those whose needs are ultimately to be served or whose preferences in matters of reproduction it is hoped to influence. This should help the family planning programme to become "internalized". In the past, the family planning programme failed to pay adequate attention to the users' perspectives. This resulted too often in a failure to achieve high rates of contraceptive acceptance and prevalence (Zeidenstein, 1989). Recently, the central Government came to the realization that the success of the programme demands as much in terms of the initiative and cooperation of the people as it does with regard to its status as an official programme. Hopefully this realization will soon be translated into action through the process of decentralization.

Quality of information and services

It has been argued that public services in India lack sufficient outreach, are of poor quality, and have staff who are inadequately trained. Also, family planning education suffers from funding gaps and lack of communication expertise (Coley and Camp, 1992). Past experience has shown that this situation has resulted in a poor quality of information and services. Most people in India know about sterilization and many of them know about IUDs, but knowledge about other methods is low. It is essential therefore that knowledge about other methods be improved along with improvements being made in the availability of such methods. Owing to the lack of knowledge about these methods and their often less-than-desirable effectiveness, there is little sustained motivation to use such methods. In order to popularize the use of these methods, it is essential that India's family welfare programme incorporate certain strategies to develop and improve interpersonal communication.

The programme also has suffered from bad publicity and rumours. This is the direct result of a lack of proper after-service care and concern, a low level of general awareness, apathy, coercion and people having misconceptions about certain family planning methods. It is essential, therefore, that in the future bad publicity should be avoided, but this cannot be done unless proper after-service care, follow-up services and the like are consistantly provided. Thus, it is encouraging to observe that the aformentioned national population policy draft document states:

> "The provision of quality health services and, in particular, screening and aftercare services for contraceptive acceptors are high priority issues. The credibility of the programme can improve only through improving the quality of services, efficient logistical support and better management at the grassroots level". (1994:28)

Role of information, education and communication

Information, education and communication (IEC) efforts are vital for the successful implementation of population policy. Since the inception of the family planning programme, Indian planners have attached great importance to IEC. However, the infrastructure for implementing IEC measures, both at the central Government level and in the States, remains inadequate (Expert Group on Population Policy, 1994:30). The objective of the IEC component of the family welfare programme should be to increase the general awareness of population, health and family welfare issues, particularly with the intention of creating greater demand for family

planning and health services. IEC should form the backbone of motivational efforts in disseminating messages on family planning and contraception.

In order to achieve the above-mentioned goals, it is essential that the family welfare programme utilize mass media and person-to-person communication channels. The mass media can play an important role in promoting awareness, whereas interpersonal communication can play a very important role in changing behaviour and promoting the acceptance of family planning among a variety of people.

In the past few years, India has experienced a considerable technological revolution in terms of information. A high level of communications technology is available in India, unlike in many other developing countries. These changes have also had some impact on the remotest parts of the country, but not fully. This is largely due to a lack of local interest in the contents of the networked information. Information suited to the needs and interests of the rural population needs further development. Centrally designed, stereotyped programmes for rural areas are not uncommon. The development of a regional programme, utilizing local personnel and personalities with whom people can associate, is essential if family welfare messages and related information are to be communicated more effectively. In the past, the mass media achieved limited success in making people aware of the concept of family planning, but this awareness has not resulted in the motivation of couples in terms of self-referral and the increased practice of contraception. Such advances can take place only if a mass media campaign is followed by interpersonal communication. This point has been among the weakest aspects of the Indian family welfare programme, but it could be improved by training some of the existing personnel of primary health centres and sub-centres. These comprise the workers who come into direct contact with prospective contraceptive users. Thus, it is essential that these workers be skilled in interpersonal communication techniques. It is surprising that the latest draft document of the national population policy does not clearly emphasize the role of interpersonal communication as an effective means for motivating people towards the adoption of contraception.

Development from the point of view of quality of life

There are many macro-economic models which have been developed to study the impact of rapid population growth on economic development (Leibenstein, 1954 and 1985; Nelson, 1956; Coale and Hoover, 1958). There are some other macro studies which further examined the consequences of rapid population growth on issues such as education and health costs

(Jones, 1975a and 1975b). Such studies provided strong hints about the costs likely to be involved in the development process as a consequence of population growth. As a result, most developing countries have accepted family planning programmes, indicating that they accept the general argument that a growing population hinders development and such growth should be checked in order to accelerate the process of socio-economic development.

Recently, many have come to believe that family planning programmes alone cannot bring down population growth to a level that would make development sustainable. Thus, the positive role of socio-economic development is beginning to be recognized in policy circles. It is being argued that macro development, which had been emphasized in the early debate on population and development, is not directly relevant unless it is beneficial for improving the individual's quality of life. Vijayanunni (1994:193) concludes that what is important is not overall development through large-scale projects and programmes, the benefits of which reach the common man/woman only indirectly and after a long gestation period, but welfare-loaded policies and programmes which impart direct and immediate benefits to the people. It has been asserted that India's model for development has been a major cause of its current economic conditions: i.e. it seeks increased productivity, rather than an equitable distribution of resources, and subsidies in public health and education for the poor (Ravindra, 1993:27). In the light of these arguments it is appropriate that India's population programme should be integrated with socio-economic development factors which concentrate on improving the undesirable conditions in which many people live. The most important question that needs to be asked is: "Which socio-economic aspects of the development programme are most likely to improve the individual's quality of life and influence his or her fertility behaviour"?

A number of international and national studies have shown that the level of literacy, status of women, infant and child mortality, mortality in general and level of poverty all play a major role in influencing a society's population growth rate. The experience of many Asian countries in the ESCAP region has shown that fertility decline can be achieved by a mix of these factors without large-scale industrialization and attainment of high levels of economic growth. Unless there is an improvement in these basic areas of Indian society, the country is unlikely to achieve further gains in its effort to influence the fertility behaviour of its citizens and firmly establish the small family norm.

The following section reviews the role of these development variables in the Indian context.

Table 5: Selected population related indicators: India, major States and capital

States/areas	Infant mortality rate	Literacy rate 1991		Percentage below poverty level	Percentage urban	Percentage of women in employment[b]
	1993[a]	Males	Females	1987–1989	1991	
Andhra Pradesh	64	56.2	33.7	31.7	26.8	12.3
Assam	81	62.3	43.7	22.8	11.1	29.4
Bihar	70	52.6	23.1	40.8	13.2	6.8
Delhi (Union Territory)	–	82.6	68.0	–	89.9	12.3
Gujarat	58	72.5	48.5	18.4	34.4	12.3
Haryana	65	67.9	40.9	11.6	24.8	11.7
Himachal Pradesh	63	74.6	52.5	9.2	8.7	11.0
Jammu and Kashmir	–	–	–	13.9	23.8	10.0
Karnataka	67	67.3	44.3	32.1	30.9	16.1
Kerala	13	94.5	86.9	17.0	26.4	35.1
Madhya Pradesh	106	57.4	28.4	36.7	23.2	9.7
Maharashtra	50	74.8	50.5	29.2	38.7	12.8
Orissa	110	62.4	34.4	44.7	13.4	7.9
Punjab	55	63.7	49.7	7.2	29.7	13.4
Rajasthan	82	55.1	20.8	24.4	22.9	12.2
Tamil Nadu	56	74.9	52.7	32.8	34.2	20.6
Uttar Pradesh	93	55.4	26.0	35.1	19.9	7.6
West Bengal	58	67.2	47.2	27.6	27.4	10.0
India (as a whole)	**74[c]**	**63.8**	**39.4**	**29.9**	**25.7**	**13.6**

Sources: Bose, A. *Population of India: 1991 Census Results and Methodology* (New Delhi: D. K. Publishers (P) Ltd., 1991). Central Statistical Organization, *Selected Socio-Economic Statistics for India*, Ministry of Planning and Programme Implementation, (New Delhi: Government of India, 1995).

Notes:
[a] Provisional.
[b] Percentage of women employed in organized sector.
[c] Excludes Jammu and Kashmir.

Infant mortality and expectation of life

If fertility reduction is to be achieved, infant mortality deserves the highest priority among all the social development factors mentioned. This is because society in general and specific households in particular, which are exposed to high infant mortality, tend to want high fertility in order to ensure that enough children will survive so that the family will contain the desired number of living children. Although there is evidence to suggest that the infant mortality rate has been declining steadily over the last few decades, it is still relatively high. Infant mortality was estimated to be around 74 per thousand during 1993 (table 5), which means that nearly one

out of thirteen children dies before reaching his or her first birthday. The situation is even worse in some other States. In Uttar Pradesh, Madhya Pradesh and Orissa, the infant mortality rate is in the range of 93-110 per thousand, with some rural areas experiencing even higher rates. This means that one out of nine children dies before reaching his or her first birthday.

In comparison with many other countries in the Asian region, Indian infant mortality rates are still very high. Even the world's most populous country, China, has been able to reduce its infant mortality rate to less than 30 per thousand. Jain and Visaria (1988), in their review of research done in India, indicate that a significant decline in infant mortality can be achieved primarily through the prevention of neo-natal tetanus, immunization of children and use of home-made treatments for diarrhoea. The policies and programmes of the health sector also need to concentrate on improving the occurrence of births in institutions, or at least where a trained birth attendant provides assistance. Research has shown that such improvements tend to lower infant mortality. Kerala State, where over 95 per cent of births occur either in institutions or are assisted by a trained birth attendant, has been able to reduce its infant mortality rate to 22 per thousand.

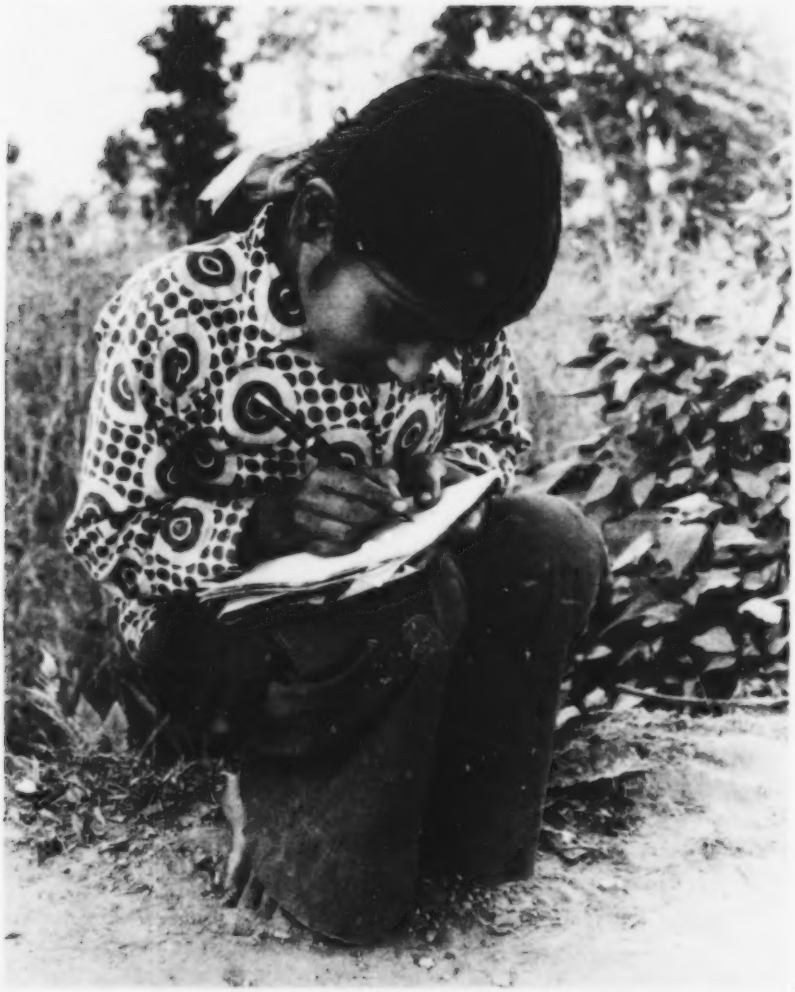
With the new emphasis on decentralization contained in the national population and family welfare policy, it will be possible to identify specific local areas where the risk of infant mortality is high and incidence of birth attendance by trained personnel is low. This will mean that programme emphasis could be directed towards achieving a lower level of infant mortality by making efficient use of the resources allocated, even without a significant improvement in the level of economic development. Universal immunization and ante-natal care programmes could be intensified in such targeted areas, thus reducing the cost of these services and making them accessible to low-income families through family welfare and health programmes. Such steps are likely to bring the population closer to the health system and thus indirectly increase the utilization of health system facilities for delivering babies, for family planning and for treating the ill. In this way, family planning could be seen as a part of the country's general welfare programme. As implied in the Bali Declaration on Population and Sustainable Development, the attainment of lower levels of infant mortality should be the prime objective of any population and welfare policy that is concerned about the quality of life of the people and the reduction of fertility. This is particularly so in Indian society, where children, especially sons, are considered as social security assets for their parents' old age. In such a setting, parents can hardly be expected to reduce their fertility if infant and child mortality rates are high.

There has also been some modest improvement in lowering overall mortality in India during the past few decades. The expectation of life at birth has risen from 50 years in the early 1970s to 58 years during the period 1986-1990, and 62 years in 1996 according the most recent estimate (ESCAP, 1996), a level that is very low compared with those of various other countries at the same level of socio-economic development, e.g. China (about 69 years), the Philippines (about 68 years) and Sri Lanka (about 73 years) (ESCAP, 1996). These countries have been able to achieve a higher life expectancy through their public health and welfare programmes. The improvement in infant mortality and mortality rates in general contributes substantially to the overall improvement of the individual's and family's welfare and results in a better quality of life for the people. Benefits experienced at the individual and family level due to a lowering of infant and general mortality rates help to create a positive environment which favours a downward trend also in fertility.

Status of women

It is being increasingly recognized that there is a close association between various aspects of women's status or position in society and demographic patterns of fertility, mortality and migration. This association has been shown to be more pronounced in respect of fertility and the social processes associated with it. General improvement in the status of women, accompanying their growing economic, social and political participation outside the home, has resulted in the need for families to shift some household functions that have traditionally been performed by women to other family members. A review of demographic research around the world clearly indicates that fertility decreases as the status of women improves. While it is difficult to assess accurately the status of women within society and individual households, it is generally agreed that indices relating to educational, health status and labour force participation are particularly important for studying the association between population and the status of women.

It is widely recognized that the status of Indian women is low; for the majority, equality of women with men is more an exception than the rule. It has been argued that this situation is largely due to India's high level of poverty, but this view does not hold up when the status of women is compared with the situation in some equally poor societies. The causes are complex and go beyond the intention of this article. However, it is a fact that women in India have limited access and opportunities in such areas as education, health and employment. As India's 1991 census data show, only



Increased educational opportunities for girls and women are needed to increase their participation in society. Unless significant progress is achieved in improving the status of women in India, a further reduction in fertility is highly unlikely.

39 per cent of females aged seven years and older are literate, whereas male literacy for the same age group is nearly 25 percentage points higher. Further, female literacy varies widely according to State, ranging from as high as 87 per cent in Kerala to as low as 21 per cent in Rajasthan (table 5). Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan, which together account for nearly 40 per cent of India's total population, have a female literacy rate of approximately 25 per cent. Thus, if the situation of women in India as a whole is to improve, obstacles to women's advancement in the field of education must be removed in order to increase their literacy and ability to participate fully in society. Women must be able to enjoy a considerable measure of autonomy if the country is to attain its socio-economic development goals. The examples of Sri Lanka and Kerala State (India) clearly demonstrate that, when such obstacles to women's advancement are eliminated and a high level of literacy is achieved, there is a distinct improvement in the content and pace of development as well as in the quality of life of the entire community (Salas, 1984:24).

Improvement in the status of women achieved through education increases their access to other value systems and also improves women's knowledge, attitudes and practice of family planning (Mason, 1984:45). Such improvements would also increase the effectiveness of the family welfare programme in India. Caldwell and others (1988) report from their intensive investigation of demographic change in rural Karnataka that husbands treated wives who had been to school differently and listened to them more closely than husbands whose wives had not been to school. Education thus increases women's participation in the decision-making process with regard to family size. Improved status of women in India through increased education and higher literacy should result in a sustained decline in fertility. It would also improve the overall quality of family life. For example, an educated mother is better able to understand the need for and practice of hygienic forms of child care and thus can positively influence the rate of infant and child survival.

The four aforementioned States with high female illiteracy also have fertility levels that are higher than those for India as a whole. Further, in those States, the percentage of women employed in the organized sector is very low. According to the 1991 census, only 13.6 per cent of the female labour force is employed in the organized sector (table 5), which indicates a lower status of women and increasing economic dependency, and in turn reduces their power in family decision-making. Put simply: unless significant progress is achieved in improving the status of women in India, a further reduction in fertility is highly unlikely.

Level of poverty

Population and poverty are both linked with the welfare of the individual, the overall quality of life in a society, and, by the same token, national development. The interrelationships between population and poverty can be examined at two levels: the macro, or aggregate level, and the micro, or household level. It is the micro level, where decisions are usually made with regard to family size, that serves as the starting point for most of the interactions between poverty and fertility. Nearly 30 per cent of India's population live below the poverty level (table 5); in some States the percentage of people living in poverty is as high as 40-44 per cent. Such a large proportion of the population living in poverty has an overall negative effect on the quality of life of the people. This is manifested in many ways. For example, high infant and child mortality rates are common among the poor. Since poor parents desire to have some of their children survive to provide support for them in their old age, they maintain high fertility rates in order to offset high infant and child mortality rates; in other words, they have more children than they actually need for "insurance" purposes (ESCAP, 1985). Another factor contributing to high fertility among the poor is their lack of knowledge of and access to family planning methods and services, as well as the lack of the means to practise the methods. It is essential therefore that poverty be alleviated and unemployment and under-employment be reduced. In addition there must be social "safety-nets" in the face of insecurity, child morbidity and mortality if the small family norm is to be accepted in India. Thus, the minimum needs programme needs to be pursued much more rigorously by the Government in order to improve the basic quality of life for the majority of India's population.

Discussion and concluding remarks

In order to achieve a greater demographic impact, the image of the family welfare programme has to be changed, that is from being solely a birth control programme to a programme for improving the people's quality of life. Today the Indian programme stands at the crossroads of the future: joint efforts through the improvement of the quality of family welfare services and a basic improvement in the quality of life (achieved through improvements in literacy, status of women and infant mortality, and a reduction in the level of poverty) are prerequisites for India to achieve its stated objectives of reaching replacement-level fertility – a TFR of 2.1 – by the year 2010.

If the current programme emphasis and format continues, then even a family's own practice of birth control may come to be seen as not a personal

but a governmental responsibility. Unfortunately there are many who are beginning to assume that fertility control cannot be practised without a government family planning programme. This kind of thinking needs to be changed. Otherwise the Indian Government will find itself committed to a major long-term programme which it may find increasingly difficult to sustain.

The sooner this responsibility is transferred to individual families the better. This cannot be done without paving the way for the acceptance of the small family norm by society. In this regard, it is essential to increase the contraceptive prevalence rate from the current 44 per cent to at least 70 per cent in order to achieve the aforementioned goal of replacement-level fertility and maintain it at that level. This cannot be done without some improvement in socio-economic conditions; family planning alone cannot provide the solution. There exists a threshold above which socio-economic development has to rise in order for the small family norm to prevail in a society. The programme certainly needs to be focused at achieving various welfare-oriented targets rather than increasing the number of contraceptive acceptors (particularly acceptors of sterilization). Also, to improve the effectiveness of the family planning programme, it needs to become decentralized to reach people at the grassroots level, mainly in the villages. Such a strategy might in the immediate future slow down the current decline in fertility while the necessary changes are being implemented, but this would be for the long-term good of the people and the country. The one thing that cannot be allowed to happen is for the authorities to panic once again and resort to drastic action if they observe what would be only a temporary stalling of the fertility decline.

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Reproductive Preferences in Matlab, Bangladesh: Levels, Motivation and Differentials

Improvements in educational and employment opportunities for women and raising their status are needed to bring about a rapid decline in desired family size

By Abdur Razzaque*

Preferences for family size or for sex of a child reflect the values attributed to children within a given cultural setting as well as individual considerations: such preferences indicate the demand for children (United Nations, 1987). In traditional societies family size preferences are found to be greater than actual fertility, but in developing countries the family size

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preferences are lower than actual fertility; in developed countries the two are similar (Ware, 1974).

Although demographers have been successful in identifying direct determinants of actual fertility (Bongaarts, 1978), they have not yet been able to identify the direct determinants of reproductive preferences. Moreover, socio-economic differentials of actual fertility have long been known, but socio-economic differentials of reproductive preferences were almost unknown until recently. Using the percentage of women wanting more children as contained in World Fertility Survey data, Brackett and others (1978) were the first to dispute the hypothesis that uneducated women had unrestricted fertility desires or desired a very much higher number of children than educated women. In subsequent studies using World Fertility Survey data, the United Nations (1981) and Lightbourne (1984) examined both the percentage of women wanting more children and mean desired family size, and reported that reproductive preferences vary little by socio-economic status.

The issue of whether desired family size or actual fertility falls first is yet to be resolved. In Costa Rica, fertility preferences appeared to change very little either before or during the decade when fertility itself was falling dramatically (Stycos, 1984). In the Republic of Korea (Cho and others, 1982), Thailand (Knodel and others, 1982) and Taiwan Province of China (Sun and others, 1978), desired family sizes fell only after the fertility transition was under way.

In the treatment area of Matlab in Bangladesh, the total fertility rate in 1990 was 3.6, whereas it was 5.2 in the comparison area. The two areas are virtually the same with respect to social and economic setting, but differ in the availability and use of contraception. The objectives of this article are to examine the levels, motivation and differentials of reproductive preferences in the treatment and comparison areas of Matlab in 1990-1991. More specifically, it examines whether reproductive preferences and the motivation behind the preferences are similar in the two areas and whether reproductive preferences vary by socio-demographic subgroups.

Methods and materials

The study area

The data for the present study come from Matlab *upazila* (sub-district) where the International Centre for Diarrhoeal Disease Research,

Bangladesh, has been maintaining the Demographic Surveillance System since 1966. Matlab is about 70 km south-east of Dhaka, the national capital. The area is a low-lying deltaic plain intersected by the tidal river Gumti and its numerous canals (for details, see Ruzicka and Chowdhury, 1978; D'Souza, 1981).

The Matlab study area consists of both treatment and comparison areas. The treatment area was exposed to the Contraceptive Distribution Programme during the period 1975-1977 and has been exposed to the Family Planning and Health Services Programme since October 1977, while in the comparison area services are limited to those received through the conventional government service programme (for details, see Bhatia and others, 1980). Contraceptive use was low in both areas in 1975, but increased to 12.6 per cent in 1977 and to 31.1 per cent in 1978 in the treatment area after introduction of the Family Planning and Health Services Programme and remained at the same level until 1982. Since then contraceptive use has been increasing, reaching 60.6 per cent in 1990. In the comparison area, contraceptive use is much lower than in the treatment area although it has also been increasing, i.e. from 4.7 per cent in 1977 to 16.5 per cent in 1984 and to 27.2 per cent in 1990.

A remarkable decline in fertility has been observed in the treatment area since the introduction of the Family Planning and Health Services Programme in 1977. The total fertility rate declined from 6.9 children per woman in 1976 to 5.1 in 1980, 4.1 in 1987 and 3.6 in 1990, while the total fertility rate in the comparison area also declined, from 7.2 in 1976 to 6.7 in 1980 and 5.2 in 1987 and 1990.

Partly as a result of the Family Planning and Health Services Programme, the crude death rate in the treatment area declined from 12.5 per thousand in 1978 to 10.0 per thousand in 1985 and 7.6 per thousand in 1990, while the crude death rate in the comparison area declined with some fluctuations, from 13.8 per thousand in 1978 to 14.1 per thousand in 1985 and 9.4 per thousand in 1990. The general mortality decline, however, has been due in particular to improvements in infant and child mortality.

The data

As the measurement of reproductive preferences is controversial, both quantitative and qualitative data were used to examine motivation for ideal family size. In order to examine the levels and differentials in reproductive preferences, two widely used indicators, namely desired family size and desire for more children, were employed.

The study was based on three data sets: the Knowledge, Attitude and Practice (KAP) survey of 1990, Socio-economic Survey (SES) of 1982 and Qualitative Survey (QS) of 1991. The primary objective of the KAP survey was to provide updated information on contraceptive use, reproductive preferences, and maternal and child health service performance for both the treatment and comparison areas (Koenig and others, 1992). A multi-stage sampling procedure was employed: 31 villages were randomly selected from the treatment area and 36 villages from the comparison area. The number of respondents interviewed totalled 4,238 in the treatment area and 3,708 in the comparison area. In the KAP survey, women were asked: "Do you want more children in the future?" "How many more do you want to have?" and "How long do you wish to delay your next child?" Women were also asked: "If you could begin childbearing again, how many children would you like to have?" The last SES was conducted in 1982 and the present study uses information from it on religion and possession of household items.

A qualitative interview programme, lasting for five weeks, was conducted in July 1991. Collected was information on family size ideals ("How many children do you consider ideal for a newly married couple?"), reasons for wanting particular numbers of children, whether children were considered to provide old-age security, and why parents and grandparents had had many children. Four villages were chosen purposively: two in the treatment area and two in the comparison area. Forty women were interviewed, 20 in the younger age group (under 30 years of age, with one or two living children) and 20 in the older age group, 10 each from the treatment and comparison areas in each instance. The older group consisted of women who had expressed a desire to cease childbearing in 1984, but had delivered babies during the period 1984-1991. The younger women were selected purposively from the same households as the older women if available, otherwise from the same or a neighbouring *bari* (patrilineally related households). The interviews were conducted by a woman who had been working at the ICDDR,B as an interviewer for the previous two years, was known to the community and had some experience in conducting in-depth interviews. Each discussion lasted about two hours and was conducted during the daytime. To develop a friendly atmosphere, the interviewer was instructed to spend some time with the respondent before starting the discussion. To guide the discussion, the interviewer used a schedule and recorded answers on it. However, a tape-recorder was purposely not used because it could have attracted other household members, particularly children, to come close to the place where the interview was conducted and thus nullify the level of privacy that was desired. To gain some idea of whether reproductive preferences in the Matlab study area are similar to those in other areas of Bangladesh, seven women from the area adjoining

the Matlab study area were also interviewed. These women had been visiting the *upazila* health complex with their children and the discussions were recorded on tape.

To examine differentials in reproductive preferences, analysis was carried out for currently married, non-pregnant women aged 15-49. Pregnant women were excluded because preferences for some of these women might depend upon the sex of the unborn baby. To minimize rationalization, desired family size was also analyzed for women under age 25. In this regard Pullum (1983) found that one of the best strategies to resolve the problem of rationalization is to restrict analysis to those at an early stage of the family-building process. For whether more children are wanted, analysis was also carried out separately for woman of parity three. These women are of particular interest since about 65 per cent of all women wanted to stop childbearing at this parity.

For the multivariate analysis, the method of multiple classification analysis was used to analyze the interval-level dependent variable (desired family size) and logistic regression to analyze the binary dependent variable (desire for more children). For desired family size, analysis was undertaken for women aged 15-49 and for those aged under 25. Used as covariates in examining socio-economic differentials of desired family size were the following: for women aged 15-49, the age of the woman and number of living children; and for women aged under 25, number of living children. For desire for more children, analysis was undertaken for women aged 15-49 and for those with family size of three children. In the case of desire for more children, the dependent variable was given the value 1 if the respondent wanted more children and 0 if she did not. The independent variables used in the logistic regression were age of woman, number of living children, education of woman, education of husband, possession of items, religion and use of contraception; age of woman and number of living children were used as continuous variables. For both multiple classification analysis and logistic regression, education of woman (0, 1-4 and 5+years), education of husband (0, 1-5 and 6+ years) and possession of items (none, 1-2 and 3+) were grouped into three, while religion (Muslim and Hindu) were dichotomized. Education levels were obtained by asking about completed years of schooling in the modern sector; religious education, which does not lead to a certificate, was not counted. The education categories of the women were defined differently from those of their husbands to get sufficient numbers in each category. Possession of household items, such as radio, watch, bicycle or quilt, and the receiving of remittances were considered here to be indicators of a household's economic condition.

The quality of data on reproductive preferences can be assessed to some extent through non-response levels, test-retest reliability studies and inter-item consistency analysis. Over the period between 1975 and 1990, the non-response for desired family size declined dramatically, from 17.1 per cent to 1.7 per cent in the treatment area and 27.2 per cent to 3.4 per cent in the comparison area. An inter-item consistency check was made on the 1990 KAP data: desire for more children was compared with desired family size. Of those who wanted more children about 80 per cent were consistent compared with 95 per cent of those who wanted no more children.

Reproductive preferences

Levels

Table 1 shows reproductive preference levels for the treatment and comparison areas in 1990. Mean desired family sizes were found to be similar, but the percentage desiring more children was slightly higher in the treatment area than in the comparison area. Two populations with identical desired family size distributions could have very different proportions of women not wanting more children if they had different tempos of childbearing, which depend upon such factors as level of contraceptive use, breastfeeding pattern and post-partum abstinence (Lightbourne and MacDonald, 1982; United Nations, 1987). When the percentage desiring more children in the comparison area was standardized, the percentages were, however, found to be closer in the two areas (46.2 compared to 47.9).

Reproductive preferences in the two areas were further examined through qualitative interviews using the ideal family size question: "How many children do you consider ideal for a newly married couple?" Examples of responses of the 20 women interviewed in each area are as follows:

A couple should have two boys and one girl.

(35-year-old mother of four boys and a girl, treatment area)

A couple should have one boy and one girl.

(18-year-old mother of a boy, treatment area)

A couple should have two boys and one girl.

(39-year-old mother of five boys and three girls, comparison area)

Table 1: Reproductive preferences of currently married, non-pregnant women aged 15-49, in treatment and comparison areas

Area	Desired family size			Desire for more children		
	Mean*	Non-numerical (%)	N	Percentage	Non-numerical (%)	N
Treatment	3.12	1.7	3,648	46.2	1.1	3,669
Comparison	3.24	3.4	2,814	42.7(47.9)*	2.3	2,846

* *Note*: Standardized for number of living children in the treatment area.

A couple should have one boy and one girl.

(36-year-old mother of six boys and a girl, comparison area)

To examine whether reproductive preferences in the treatment and comparison areas are similar to those in other areas of Bangladesh, the ideal family size question was also asked through qualitative interviews with women residing in the area adjoining the Matlab study area. Examples of responses of the seven women who were interviewed while visiting the *upazila* health complex are as follows:

A couple should have two boys and one girl.

(30-year-old mother of two boys and one girl, adjoining Matlab study area)

One should be happy with two, either boys or girls.

(25-year-old mother of two boys and one girl, adjoining Matlab study area)

The above results suggest that motivation for ideal family size is similar in the treatment and comparison areas and a similar motivation also exists in areas adjoining it; this may reflect national-level estimates.

The desired family size data collected in the 1990 KAP survey was found to be 28.0 per cent lower than those recorded in 1975 by the contraceptive distribution project (Koenig and others, 1987). As there are no other data available for the Matlab study area between 1975 and 1990, it is not known whether or not desired family size declined gradually. However, one study from another rural area of Bangladesh conducted in 1985 found a mean desired family size of 3.0 (Hoque, 1988), which suggests that the decline probably occurred during the period 1975-1985.

Motivation

Studies conducted in Bangladesh up until the early 1980s found that familial, social, economic and religious conditions were favourable to having many rather than few children (Arthur and McNicoll, 1978; Cain, 1977, 1981, 1983). From a village study, Khuda (1977) concluded that a large family, with both boys and girls, was an asset to the household and Cain (1977) noted that children, especially sons, provided parents with significant net economic returns through their labour. In a comparison with India, Cain (1981) argued that in a rural economy, when senility, illness or environmental disaster strike, children, especially sons, are needed for long-term family security. However, Robinson (1983) argued that it is not the high benefit but the very low cost of children which induces high fertility. According to Robinson, at a very low cost, even a modest benefit would make the value of children positive. In the remainder of this section, qualitative data are presented to examine the motivation for ideal family size when fertility decline is under way: fertility decline has, however, been much steeper in the treatment area than in the comparison area.

As reproductive preferences have been found to be similar in the treatment and comparison areas, the qualitative data presented below are not shown by area. The younger women interviewed in the qualitative survey possessed on average 1.9 items compared with 1.1 items for older women. They had almost no education (mean schooling 1.8 years compared with 0.6 years), and their mean ages and mean numbers of living children were 25 and 1.2, respectively, for younger women, and 39 and 6.1 for older women.

Both younger and older women were asked the ideal family size question. As younger women had 0-2 children, it was assumed that their own desired family sizes would be reflected, while older women were expected to report their perceptions of the family size preferences of the generation just commencing family formation. The mean ideal family size was 3.2 children for younger women compared with 3.0 children for older women. The following section examines motivation behind the reported ideal family size.

Increase in cost of living

In the qualitative interviews, younger women were asked about the advantages and disadvantages of having the small family sizes which they reported as ideal. Older women were asked the same question, but with reference to the number they considered ideal for a younger couple. Almost every woman from both the younger and the older groups reported that it was the increase in the direct economic cost of children that had influenced ideal family size to decline.

One will face difficulties in providing food, education and land for cultivation, so a small family is better.

(45-year-old mother of six boys and four girls)

It is difficult to provide food, clothing and education. Many children create many problems. My husband's income is low, so few children is better.

(34-year-old mother of two boys and one girl)

Availability of family planning method

Women were asked why their fertility preferences were low compared with the number of children their parents and grandparents had had. Almost all women reported that family planning was not available in the past, and some also said that there were more resources per capita in the past.

They had plenty of property and also family planning methods were unavailable.

(36-year-old mother of six boys and one girl)

Family planning methods were not available.

(26-year-old mother of two boys and two girls).

Change in perception of old-age security

To seek insight into the contemporary link between fertility and old-age security, women were asked whether they considered the option of having a large family so that their children could provide security for them in their old age. Out of 40 women, none supported the contention that large families, of a size similar to those of their parents and grandparents, provided security for old age. Moreover, their statements favoured the quality rather than quantity of children.

I do not think many children is a strength for the family. If you have many children, you can't properly educate them. So few children is better.

(30-year-old mother of one boy)

I think many children create many problems. In these days, boys do not look after parents, so having many children is bad.

(45-year-old mother of seven boys and two girls)

Favourable attitude of in-laws

It is often argued that in societies such as Bangladesh, other family members (in-laws) have a major role in fertility decision-making for couples. On three occasions mothers-in-law were interviewed, and their reactions towards small family size were positive.

My daughter-in-law is very young (recently delivered a baby boy) and does not know about family planning, but we will tell her in the future what she needs to do to keep a small family size because times have changed.

(A mother-in-law)

The foregoing responses indicate that motivation for small family size is widespread; however, these motivations were absent even a decade ago. Motivations were found to be similar for both younger and older women.

Differentials

Desired family size

Demographic differentials: In both areas, the mean desired family size increased with the age of the woman; the difference in the number of children desired between women aged under 20 years and those 40 years and older was about half a child (table 2). When mean desired family size was adjusted for number of living children, the relationship was reversed: desired family size was higher for younger age groups and lower for older age groups. The differences between women aged under 20 and those 40 years and older were 0.3 of a child in the treatment area and 0.4 of a child in the comparison area. A similar finding has been documented for Jamaica after adjusting for the number of living children and number of living children squared (Lightbourne, 1984). Desired family size may be higher for younger than for older age groups because the older age groups are more aware of the cost of a large family than are the young ones, whose members have not yet experienced the burden of excess childbearing. The finding of minimal difference in desired family size between younger and older women suggests that when desired family size changes it changes in all generations equally.

Table 2: Mean desired family sizes of currently married, non-pregnant women aged 15-49, by age of woman and areas

Age of woman (years)	Treatment area			Comparison area		
	Unadjusted	Adjusted*	N	Unadjusted	Adjusted*	N
<20	2.90	3.33	187	3.00	3.53	145
20-24	2.92	3.22	720	3.02	3.35	592
25-29	2.97	3.08	879	3.11	3.24	673
30-34	3.15	3.08	667	3.33	3.22	488
35-39	3.28	3.08	514	3.38	3.13	378
40+	3.44	3.08	681	3.52	3.12	538

Note: * Adjusted (by regression) for number of living children.

In both areas, mean desired family size, with minor exceptions, increased with number of living children; the difference in mean desired family size between those who had no child and those who had seven or more children was 0.8 of a child in the treatment area and 0.9 of a child in the comparison area (table 3). When mean desired family size is adjusted for age of woman, an essentially positive relationship remains; however, the difference between women with no child and those with seven or more children becomes wider, i.e. 1.0 child in the treatment area and 1.1 child in the comparison area. This result replicates findings for Guyana, Jamaica and Trinidad and Tobago after adjusting for age and age squared (Lightbourne, 1984). The results indicate that parity affects women's reports on the number of children desired; implementation of preferences, rationalization of achieved family size and underestimation of eventual desired family size are operating here to produce these relationships (Razzaque, 1994).

Table 3: Mean desired family sizes of currently married, non-pregnant women aged 15-49, by number of living children and areas

No. of living children	Treatment area			Comparison area		
	Unadjusted	Adjusted*	N	Unadjusted	Adjusted*	N
0	2.80	2.71	232	2.89	2.78	203
1	2.78	2.70	604	2.80	2.72	401
2	2.87	2.83	693	2.97	2.92	439
3	3.12	3.12	661	3.16	3.14	469
4	3.40	3.44	570	3.49	3.52	420
5	3.37	3.44	441	3.44	3.50	355
6	3.48	3.57	255	3.57	3.65	260
7+	3.60	3.71	192	3.77	3.88	267

Note: * Adjusted (by regression) for age of woman.

Table 4: Mean desired family sizes of currently married, non-pregnant women aged 15-49 and under 25, by socio-economic characteristics and areas

Characteristics	Treatment area				Comparison area			
	Aged 15-49		Under age 25		Aged 15-49		Under age 25	
	Mean	Adj. for SES, NLC, AGW	Mean	Adj. for SES, NLC	Mean	Adj. for SES, NLC AGW	Mean	Adj. for SES, NLC
Column No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Education of woman (years)								
0	3.19	3.16	3.00	2.97	3.30	3.26	3.09	3.05
1-4	3.12	3.12	2.95	2.93	3.25	3.24	3.04	3.03
5+	2.92	3.02	2.75	2.82	3.03	3.18	2.81	2.91
P-value	0.00	0.00	0.00	0.09	0.00	0.31	0.00	0.16
Education of husband (years)								
0	3.19	3.16	3.00	2.97	3.30	3.27	3.09	3.04
1-5	3.14	3.12	2.97	2.96	3.29	3.25	3.06	3.05
6+	3.00	3.07	2.75	2.81	3.09	3.17	2.85	2.93
P-value	0.00	0.05	0.00	0.04	0.00	0.06	0.00	0.23
Possession of items								
None	3.18	3.13	2.97	2.90	3.28	3.26	3.09	3.04
1-2	3.12	3.13	2.94	2.97	3.23	3.24	2.99	3.02
3+	2.95	3.05	2.74	2.84	3.13	3.19	2.78	2.85
P-value	0.00	0.06	0.00	0.15	0.01	0.44	0.00	0.10
Religion								
Muslim	3.14	3.13	2.92	2.93	3.24	3.24	3.01	3.01
Hindu	3.03	3.06	2.90	2.88	3.28	3.26	3.05	2.99
P-value	0.00	0.02	0.75	0.46	0.46	0.61	0.66	0.85
Grand mean	**3.12**		**2.92**		**3.24**		**3.01**	

Note: Adj = adjusted; SES = socio-economic status; NLC = No. of living children; AGW = age of woman.

Socio-economic differentials: In the treatment area, the mean desired family size of women aged 15-49 was inversely related to the education of the woman, education of her husband and possession of items (table 4, column 1). Muslims had a higher mean desired family size than Hindus. For women under age 25, the patterns were similar to those of women aged 15-49 (column 3). When the mean desired family size of women aged 15-44 were adjusted for the age of the woman, number of living children and other socio-economic variables (column 2), the same patterns were found as in column 1, but within-category differences for education of husband and

possession of items became insignificant. For women aged under 25, when the means were adjusted for number of living children and other socio-economic variables (column 4) the patterns were usually similar to that for women aged 15-49 (column 2), but the inter-category differences, except for education of husband, became insignificant.

In the comparison area the mean desired family size of women aged 15-49 was inversely related to education of the woman, education of her husband and possession of items (table 4, column 5). Hindus had a higher mean desired family size than Muslims. For women under age 25, the patterns were similar to those of women aged 15-49 (column 7). When the mean desired family size of women aged 15-49 was adjusted for the age of the woman, number of living children and other socio-economic variables (column 6), the same patterns were found as in column 5, but within-category differences became insignificant. For women aged under 25, when the means were adjusted for number of living children and other socio-economic variables (column 8), the patterns were usually similar to those for women aged 15-49 (column 6).

At the multivariate level, the mean desired family size did not usually vary significantly by socio-economic categories in either area for either women aged 15-49 or those aged under 25. In fact, the differences in mean desired family sizes by socio-economic categories never exceeded 0.2 of a child, even when they were significant; from a practical point of view, these differences are negligible. Thus, it can be argued that desired family sizes are homogeneous across socio-economic categories.

Desire for more children

Demographic differentials: In both areas, the percentages and adjusted percentages (for number of living children) wanting more children decreased with increases in the age of the women (table 5). A similar finding has been documented for Jamaica, Guyana, and Trinidad and Tobago (Lightbourne, 1984). Several reasons can be offered to explain the higher percentages of older women not wanting more children after the number of living children has been adjusted. The first is the selection effect: by age 35, most women who have, for example, only two children may have wanted only two, whereas proportionately more younger women with only two children may have wanted more, but have not yet had time to achieve their desired family size. Secondly, older women may want to avoid births once they have children old enough to marry and bear children themselves; this has often been called the "grandmaternal" effect (Tan, 1983). Thirdly, women who have fewer children by a given age may be more aware of child-bearing costs as they become older and so wish to cease childbearing.

Table 5: Percentages of currently married, non-pregnant women aged 15-49 who wanted more children, by age of woman and areas

Age of woman (years)	Treatment area			Comparison area		
	Unadjusted	Adjusted*	N	Unadjusted	Adjusted*	N
< 20	99	71	187	100	70	145
20-24	92	72	720	89	70	594
25-29	61	54	880	57	50	671
30-34	32	36	669	21	26	491
35-39	13	26	520	12	25	383
40+	3	26	693	3	26	562

Note: * Adjusted (by regression) for number of living children.

In both areas, the percentages and adjusted percentages (for age of the women) wanting more children decreased with increases in the number of living children (table 6). The fall in percentages wanting more children with increases in the number of living children occurs because, once desired family size has been attained, the desire for more children ceases.

Socio-economic differentials: In the treatment area, the percentage of women aged 15-49 who wanted more children was positively related to education of the woman and possession of items, and it exhibited a U-shaped relationship with education of her husband (table 7). This was similar for Muslims and Hindus. For family size of three children, the pattern was different from that for women aged 15-49: desire for more

Table 6: Percentages of currently married, non-pregnant women aged 15-49 who wanted more children, by number of living children and areas

No. of living children	Treatment area			Comparison area		
	Unadjusted	Adjusted*	N	Unadjusted	Adjusted*	N
0	99	84	232	100	85	203
1	98	85	604	98	87	400
2	75	68	692	78	70	440
3	35	35	664	40	37	469
4	14	20	572	15	18	423
5	7	18	448	7	16	360
6	1	17	257	4	15	266
7+	1	20	200	1	17	285

Note: * Adjusted (by regression) for age of woman.

Table 7: Percentages desiring more children, of currently married, non-pregnant woman aged 15-49 with family size of three children, by socio-economic characteristics and areas

Characteristics	Treatment area				Comparison area			
	Aged 15-49		Family size 3		Aged 15-49		Family size 3	
	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)
Column No.	**1**		**2**		**3**		**4**	
Education of woman (years)								
0	44	2,217	39	402	40	1,841	40	304
1-4	48	672	35	120	44	496	46	84
5+	51	780	24	142	54	509	28	81
P-value	0.00		0.01		0.00		0.05	
Education of husband (years)								
0	47	1,579	39	278	42	1,348	36	213
1-5	44	983	38	183	39	750	41	125
6+	45	1,107	27	203	49	748	41	131
P-value	0.29		0.01		0.00		0.57	
Possession of items								
None	45	1,449	37	255	42	1,315	37	228
1-2	46	1,681	34	302	44	1,170	43	157
3+	49	539	32	107	42	361	38	84
P-value	0.30		0.52		0.46		0.43	
Religion								
Muslim	46	3,051	37	523	43	2,584	39	419
Hindu	46	618	29	141	39	262	42	50
P-value	0.98		0.08		0.20		0.67	
Grand mean	**46**		**35**		**43**		**39**	

children was negatively related to education of the woman, education of her husband and possession of items; also, it was higher for Muslims than for Hindus. After all variables were controlled, better educated women (5+ years of schooling) in either group (aged 15-49 or having a family size of three children) were less likely than illiterate women to desire more children (table 8).

In the comparison area, the percentage of women aged 15-49 who wanted more children was positively related to education of the woman, and it exhibited a U-shaped relationship with education of her husband and an inverted U-shaped relationship with the possession of items (table 7). The

Table 8: Results of logistic regression models of proportion desiring more children, of currently married, non-pregnant women aged 15-49 and those with family size of three children, by selected characteristics and areas

Characteristics	Treatment area						Comparison area					
	Aged 15-49			Family size: 3 children			Aged 15-49			Family size: 3 children		
	B	SE	Odds ratio	B	SE	Odds ratio	B	SE	Odds ratio	B	SE	Odds ratio
Constant	6.950	0.292		3.669	0.617		6.449	0.308		3.392	0.623	
Age of woman	−0.141	0.011	0.87	−0.141	0.020	0.87	−0.131	0.011	0.88	−0.132	0.021	0.87
No. of living children	−0.998	0.052	0.36				−0.959	0.051	0.38			
Education of woman (years)												
0			1.00			1.00						
1–4	0.072	0.074	1.07	0.153	0.126	1.16						
5+	−0.232	0.072	0.79	−0.411	0.127	0.66						
−2 Log-likelihood (df)	2560.5 (3705)			797.7 (666)			1948.4 (2911)			587.3 (474)		

percentage wanting more children was higher for Muslims than for Hindus. For a family size of three children, the pattern was similar to that for women aged 15-49 for possession of items only. It had an inverted U-shaped relationship, with education of the woman and the percentage wanting more children being lower for those with illiterate than literate husbands; and it was higher for Hindus than for Muslims. After all variables were controlled, desire for more children was found to be largely insignificant in either group (aged 15-49 or having a family size of three children) for the socio-economic variables considered here (table 8).

Discussion

The issue of the meaningfulness of reproductive preference data has not yet been resolved. Desired family size data, particularly from developing countries, have been criticized for fatalistic responses and forced responses to questions for which the respondent really has no answer. But in the 1990 KAP survey in Matlab, the rate of non-response was found to be very low. Observations from the field during the qualitative data collection process were also convincing; respondents were able to give spontaneous responses to the ideal family size question and provided valid reasons for choosing their ideal family sizes.

Studies conducted until the early 1980s documented motivation for many rather than few children (Cain, 1977; Khuda, 1977; Arthur and McNicoll, 1978), but the present study found the opposite to be the case. Mean desired family size was found to be slightly over three children and women said that they preferred usually to have two sons. In the qualitative interviews it was reported that an increase in the direct economic cost of children and knowledge of family planning were mainly responsible for the small family-size desires. These days, women in Bangladesh do not believe that having many children provides strength for the family and security for their old age; rather the quality of their children is believed to be important. Moreover, it was reported that the intergenerational relationship between parents and children is changing; the costs of having many children are beginning to outweigh the benefits. Regarding decline in reproductive preference, Nag and Duza (1988) reported that the new small-family norm in the Matlab study area is mainly aspiration-induced rather than poverty-induced, but qualitative data from the present study did suggest that both aspiration and poverty are responsible for the decline in reproductive preference.

Desired family size, ideal family size and desire for more children were found to be similar in the two areas. Moreover, except for education of husband (for wanting more children) in the treatment area, neither mean desired family size nor percentage wanting more children varied remarkably by socio-economic categories for any group of women (aged 15-49 and either under age 25 or with a family size of three children). Similar reproductive preference in the two areas indicates that the Family Planning and Health Services Programme has had no effect on preference. According to Freedman and Freedman (1992), the norms for family size ideals are too deeply rooted to be changed simply by mass media messages; however, they reported that it is yet to be known whether an aggressive family planning programme has had desired impacts. Similar preferences across categories of socio-economic variables suggest that factors responsible for small family-size preferences work at the societal level and that preferences are influenced by broader socio-economic change. This has implications for both policy and programme purposes.

Further, when parities are controlled, there is no strong evidence that the younger women reported smaller family-size desires than older women. One possible explanation is that women's preferences have changed little over time; however, the argument was not supported by the data: desired family size in the Matlab area in 1990 was about 30 per cent lower than that reported in 1975. The other explanation is that women's preferences do change, but they change almost equally in all age groups. In fact, within culturally homogenous populations, change in reproductive preferences spread to all sectors over a short time (Knodel and others, 1987; Freedman and Freedman, 1992), resulting in similar preferences across age groups.

Our study found that the Family Planning and Health Services Programme in the treatment area of Matlab has been able to reduce fertility significantly compared with the comparison area, but it has not been able to reduce desired family size. Perhaps broader socio-economic change, such as improvements in educational and employment opportunities for women and raising their status, is needed to bring about a rapid decline in desired family size. Thus, policy and programme interventions are required that are in line with the new population and development paradigm adopted by the 1994 International Conference on Population and Development as part of the Programme of Action. In fact, there is a need for the Government to develop policies that better support individual members of the basic unit of society – the family – and to promote equality of opportunity for family members, especially the rights of women and children in the family.

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Women's Education and Employment: Matlab Experience

There should be policies that would promote formal education among women and provide them with off-farm employment opportunites

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The potential of education for opening up new life opportunities for both men and women was one of the themes repeatedly brought out during the 1994 International Conference on Population and Development (ICPD) as being especially important for accelerating the process of development.

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Increased opportunities for people to obtain an education, as advocated by the ICPD Programme of Action, will produce a beneficial impact on the socio-demographic condition of individual households in societies as well as the population at large. The availability of such opportunities for females is most important where there has been discrimination against females with regard to education. The extent to which females get an education in practice and similarly the extent to which they are encouraged in a society to avail themselves of the opportunity to obtain an education in the first place depends on a set of complex mechanisms. This observation applies not only to education but also to the status of women within the family and society at large – in short, all the factors which contribute to the fundamental process of empowerment of women.

The question of how women's schooling influences socio-demographic conditions of a household in particular and a community or society in general has been crucial in the analysis of demographic change and the evaluation of health and the economics of a population. An extensive literature review reveals that maternal education is a highly consistent household-level predictor of reduced fertility and infant and child mortality, even when other socio-economic factors are controlled (Caldwell, 1982 and 1986; Cleland and Ginneken, 1988; Ware, 1984; LeVine and others, 1991). Researchers agree that the direct impact of women's schooling may account for as much as half of the observed effect (Cochrane and others, 1980; Mensch and others, 1985) with the remaining half being attributed to socio-economic advantages (Joshi, 1994). However, LeVine and others (1991) argue that no research could adequately identify the intervening pathways or processes through which they are connected within any particular population.

In this study on a rural area of Bangladesh, we did not attempt to examine in detail the pathways of education because of a lack of relevant information; instead, we designed our research to assess educational differentials in a broad range of socio-economic and demographic characteristics among women aged 15 to 49 years who were currently married at the time of a baseline survey in Matlab. Specifically, we first looked at educational differentials by some selected socio-economic and demographic activities, using widely accepted statistical tests. These differentials were looked into in respect of the eligibility criteria of the Bangladesh Rural Advancement Committee (BRAC).[1] Women's employment, an important economic activity, was then more closely assessed at different levels of education after controlling for the effects of some important and significant factors. These steps would provide quantitative evidence from these communities in light of the socio-demographic conditions that form the context of the women's lives.

Materials and methods

Background of the survey

The baseline survey data collected by the BRAC-ICDDR,B (International Centre for Diarrhoeal Disease Research, Bangladesh) joint research project in Matlab have been used in the analysis. In the course of its normal expansion, BRAC decided to start its Rural Development Programme (RDP) in Matlab in 1992. Meanwhile, ICDDR,B had already been maintaining a demographic surveillance system (DSS) there for more than 25 years. The long presence of ICDDR,B in Matlab and the new initiative by BRAC provided an opportunity to collaborate on a study of the impact of economic and social development on the health and well-being of the community. More importantly, it offered an occasion to understand the mechanisms of social change through which the impact of BRAC programmes could be explained. In order to assess the impact of the RDP at the macro level, benchmark information on relevant indicators would be required. Accordingly, this baseline survey was organized with the objective of recording the status of selected indicators as they existed before RDP intervention.

Data and methods

The baseline survey was conducted in 60 villages covering 11,343 households in Matlab. For the analysis, a total of 9,853 currently married women (aged less than 50 years) comprised the sample. We then decomposed them into two groups: a BRAC-eligible group comprising 6,144 respondents, and a BRAC-noneligible group comprising 3,543 respondents.

The initial analysis included calculation of some basic statistics such as means and standard deviations, and the construction of bivariate tables to examine the possible relationships between the selected independent variables and the women's schooling according to BRAC eligibility. Proper test criteria (t, F or X^2) were then used to test for statistical significance. Finally a logistic regression analysis was employed taking "currently employed" as the dependent variable.

Results

Table 1 shows selected characteristics of the BRAC-eligible and noneligible samples. In Matlab, the average BRAC-eligible mother was found to be 31.6 years old, to have attended school for only one year, currently to have three living children but who would liked to have had at least one child

Table 1: Selected socio-demographic characteristics of women by BRAC eligibility, Matlab, 1992

Variables	BRAC-eligible (N = 6,144)		BRAC-noneligible (N = 3,543)		Test statistic
	Mean	S.D.**	Mean	S.D.**	
Age (years)	31.6	8.0	32.4	8.5	t = −4.50*
Women's schooling (years)	1.0	2.1	3.1	3.4	t = −37.28*
Number of living children	3.2	2.0	3.5	2.2	t = −4.55*
Number of children desired	2.3	1.2	2.3	1.1	t = −1.56
Amount of savings (in taka)	21.25	335.05	105.23	820.27	t = −7.07*
Amount of loan (in taka)	51.63	391.53	64.49	586.63	t = −1.29

Notes: * $p < 0.01$; ** S.D. = standard deviation.

less than that. The average number of children desired, 2.3, was below the mean (3.2) of living children, indicating that fertility limitation was not well practised among this sample. The mean amount of loans extended to them was higher than their mean amount of savings. The BRAC-noneligible sample, on the other hand, was virtually identical with the eligible sample with regard to the number of living children and desired children, but they had a higher level of schooling and were slightly older. However, this group of women had a higher level of savings than the value of loans that they had taken out (their mean amount of savings was higher than the mean amount of loans), which was contrary to the finding for BRAC-eligible women. This was expected because the BRAC-noneligible sample was, by operational definition, better off than the BRAC-eligible sample in terms of socio-economic status (Khan and others, 1993).

Table 2 shows differentials of selected socio-economic and demographic characteristics by level of schooling for the BRAC-eligible sample. The BRAC-eligible mothers with more schooling were younger and had fewer living children, but at the time of the survey said they wanted more children than did the non-eligible sample. The highest proportion of contraceptive use corresponded to respondents with 1-5 years of schooling, whereas the lowest level of use was observed for those with over six years of schooling. The reason may be that women having a higher education were younger and they had fewer living children and therefore wanted more children. As a result, they were not practising contraception as much as those in the other group.

A higher proportion of women with more schooling had savings; also, the mean amount of savings was significantly higher than for those with less schooling. Women with increased years of schooling were currently

Table 2: Selected characteristics of BRAC-eligible women by their education, Matlab, 1992

Variables	Women's schooling			Test statistic
	No education (N=4,799)	1–5 years (N=1,085)	6+ years (N=260)	
Mean age (years)	32.3	29.7	27.2	$F(2,6141) = 90.65^{**}$
Mean number of living children	3.4	2.9	1.7	$F(2,6141) = 75.2^{**}$
Mean number of children desired	2.3	2.4	2.2	$F(2,6141) = 3.8^{*}$
Practising contraception	46.3	52.0	44.4	$X^2(2) = 11.0^{**}$
Want more children	39.5	48.4	61.5	$X^2(2) = 71.4^{**}$
Percentage having taken out a loan	4.8	4.9	3.5	$X^2(2) = 1.0$
Mean amount of loan (in taka)	52.73	53.23	24.65	$F(2,6141) = 0.6$
Percentage having savings	0.8	2.2	4.2	$X^2(2) = 39.0^{**}$
Mean amount of savings (in taka)	8.61	44.93	155.77	$F(2,6141) = 27.3^{**}$
Percentage currently employed	4.0	1.9	5.0	$X^2(2) = 12.1^{**}$
Husband living with wife	92.5	88.0	80.8	$X^2(2) = 58.2^{**}$
Wash hands after defecation	57.0	61.4	71.5	$X^2(2) = 26.1^{**}$

Notes: * $p < 0.05$, ** $p < 0.01$.

employed (except for a sudden drop noted for those with 1-5 years of education); we also found more husbands living with their wives if they had less education. Usually women with higher levels of schooling marry relatively "highly educated" men; these husbands often have to go to urban areas for better jobs thus leaving behind their wives, often in their usual rural place of residence (Cleland and Ginneken, 1988). This results in a smaller proportion of husbands living with wives having a higher education. Another important indicator is the washing of hands after defecation; women with higher levels of education were found to do so, washing their hands hygienically, a practice that reflects their awareness about personal hygiene, which is a result of education.

Table 3 shows that, like the BRAC-eligible sample in table 2, there is not much difference in the pattern of differentials by schooling in the selected factors. However, it can be noticed that the use of contraceptives shows an upward trend corresponding to the level of schooling, even though there exists an extensive intervention. Another important finding is that these women had higher amounts of savings and loans than the BRAC-eligible women had. This situation indicates that BRAC-noneligible women were economically better off and more active than BRAC-eligible women and this is best expressed when the effect of their education is controlled in the analysis.

Table 3: Selected characteristics of BRAC-noneligible women by their education, Matlab, 1992

Variables	Women's schooling			Test statistic
	No education (N=1,675)	1–5 years (N=1,086)	6+ years (N=782)	
Mean age (years)	34.3	32.1	28.7	$F(2,3540) = 123.9^{**}$
Mean nunber of living children	3.9	3.5	2.4	$F(2,3540) = 136.8^{**}$
Mean number of children desired	2.3	2.3	2.2	$F(2.3540) = 2.9$
Practising contraception	42.8	43.5	49.1	$X^2(2) = 8.0^{*}$
Want more children	33.2	39.0	52.6	$X^2(2) = 83.9^{**}$
Percentage having loan	4.5	3.6	2.4	$X^2(2) = 6.7^{*}$
Mean amount of loan (in taka)	60.92	46.28	97.43	$F(2,3540) = 1.8$
Percentage having savings	1.1	2.0	8.8	$X^2(2) = 113.2^{**}$
Mean amount of savings (in taka)	18.19	56.61	359.17	$F(2,3540) = 50.2^{**}$
Percentage currently employed	1.3	1.4	7.7	$X^2(2) = 91.8^{**}$
Husband living with wife	84.8	81.5	77.0	$X^2(2) = 22.7^{**}$
Wash hands after defecation	56.5	62.5	77.9	$X^2(2) = 104.5^{**}$

Notes: * $p < 0.05$, ** $p < 0.01$

Multivariate analysis

BRAC emphasizes the involvement of poor women in economic activities; thus, it has a strong credit programme targeted especially towards these women. BRAC also undertakes an education programme for its target population. With this as a backdrop, we hypothesized that women with higher levels of education would be more likely to be employed. The bivariate analysis for both eligible and non-eligible women has shown this trend, although the proportion of economically active women is small. In order to assess the net effect of education on employment, we undertook a multivariate analysis controlling for the influence of other socio-economic and demographic characteristics. Current employment was defined by a dichotomous variable, i.e. whether or not the woman was engaged in any wage-earning activity at the time of survey. All of the selected variables were included in the initial model for both BRAC-eligible and non-eligible samples.

The multivariate approach used was logistic regression fitting the following model:

$$\ln [p/(1-p)] = a + \Sigma b_i x_i$$

where p is the probability of a woman being employed, a, b_i values are estimated regression coefficients, and x_i values are the background

Table 4: Logit coefficients and odds ratios of the model of current employment for BRAC-eligible women, Matlab, 1992

Variable	Coefficients	St. error	Odds ratio
Constant	**–5.85**	**0.46**	**–**
Age	**0.06*****	**0.01**	**1.06**
Women's education			
No education (R)	0.00	–	1.00
1-5 yrs.	–0.68***	0.24	0.51
6+ yrs.	0.44	0.31	1.55
Living children			
0-1	0.40	0.29	1.49
2-4	0.65***	0.18	1.92
5 + (R)	0.00	–	1.00
Religion			
Muslim (R)	0.00	–	1.00
Non-Muslim	0.01	0.20	1.01
Husband living with wife			
No	–0.39	0.29	0.68
Yes (R)	0.00	–	1.00
Having taken out a loan			
No (R)	0.00	–	1.00
Yes	0.88***	0.22	2.42
Having savings			
No (R)	0.00	–	1.00
Yes	1.31***	0.40	3.69
Area			
BRAC village (R)	0.00	–	1.00
Non-BRAC village	0.28*	0.14	1.32

Notes: * $p<0.10$, ** $p>0.05$, *** $p<0.01$; R = reference category.

characteristics. We estimated the models using the SPSS statistical software package and an indicator-variable coding scheme in the analysis. The reference category of the categorical variables was selected so that it had the highest frequency.

The regression coefficients for the eligible sample are displayed in table 4. Among the significant variables, women's education shows a rather different picture than expected. Women with 1-5 years of schooling were significantly less likely (by about 50 per cent) to be involved in wage-earning activities than those with no schooling. BRAC-eligible women with no education were found to be the poorest of the poor, having to go outside the home and work for money just to be able to merely survive. So the

Table 5: Logit coefficients and odds ratios of the model of current employment for BRAC-noneligible women, Matlab, 1992

Variable	Coefficients	St. error	Odds ratio
Constant	**–7.70**	**0.87**	**–**
Age	**0.07*****	**0.02**	**1.07**
Women's education			
No education (R)	0.00	–	1.00
1-5 yrs.	0.21	0.35	1.23
6+ yrs.	1.86***	0.29	6.45
Living children			
0-1	0.90*	0.48	2.45
2-4	1.01***	0.33	2.74
5 + (R)	0.00	–	1.00
Religion			
Muslim (R)	0.00	–	1.00
Non-Muslim	0.64**	0.31	1.90
Husband living with wife			
No	–0.70**	0.35	0.50
Yes (R)	0.00	–	1.00
Having taken out a loan			
No (R)	0.00	–	1.00
Yes	2.20***	0.34	9.03
Having savings			
No (R)	0.00	–	1.00
Yes	2.25***	0.29	9.52
Area			
BRAC village (R)	0.00	–	1.00
Non-BRAC village	–0.23	0.25	0.79

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.01$; R = reference category.

likelihood of being employed (and being mobile) was higher for them compared with women having 1-5 years of schooling. However, if they had more than six years of education, they were about 1.6 times more likely to do any job than those with no education, although this finding is not statistically significant. The same situation has been depicted in our bivariate results. Having savings and loans are again two variables that are important for women's employment. Alternatively we could say that, because women are currently employed and hence involved in economic activities, they possess savings and have taken out loans.

Table 5 describes the same situation for BRAC-noneligible women. In this regard, education is positively associated with employment: the higher

Table 6: Estimated probabilities* of current employment generated from logit model for BRAC-eligible women, Matlab, 1992

Characteristics	Probabilities
Age 31.6 years; 6+ years of schooling; having 2-4 living children; currently having loans and savings; and residing in non-BRAC village	0.403
Age 31.6 years; 1-5 years of schooling; 5+ living children; currently having no loans or savings; and residing in BRAC village	0.010
Effect of education for women aged 31.6 years, having 2-4 living children, currently having savings and having taken out a loan, and residing in non-BRAC villages:	
No education	0.303
1-5 years	0.180
6+ years	0.403

Notes: $^{*}p = \exp(x + \Sigma\beta_i x_i)/[1+\exp(x + \Sigma\beta_i x_i)]$.

the level of education, the more likely that the woman will be employed. In this model, all selected variables turned out to be significant except "area". Only "husband living with wife" had a negative effect on employment, describing about 50 per cent of women who were less likely to be employed if their husbands did not live with them as opposed to those whose husbands did live with them.

In both of these models, age and number of living children emerged as being positively and significantly associated with employment. Women having 2-4 living children were the group most likely to be employed as opposed to women having five or more children. The religion of women was found to be important in explaining their education only in the case of the non-eligible sample. According to the model, non-Muslim women were about twice as likely as Muslim women to be employed. Usually in rural settings, Muslim women with better socio-economic status do not do any wage-generating work but confine themselves to performing household tasks. However, the non-eligible women's employment factor is better explained by the selected explanatory variables.

It is important to know estimated probabilities that women with particular characteristics will be employed. We estimated these probabilities only for those indicators that emerged as being statistically significant in the model. A selection of such probabilities is given in table 6 for the BRAC-eligible sample and in table 7 for the non-eligible sample.

For the BRAC-eligible sample, there is no substantial difference in the range of probabilities, from 0.40 to 0.01, and the highest probability that a

Table 7: Estimated probabilities* of current employment generated from logit model for BRAC-noneligible women, Matlab, 1992

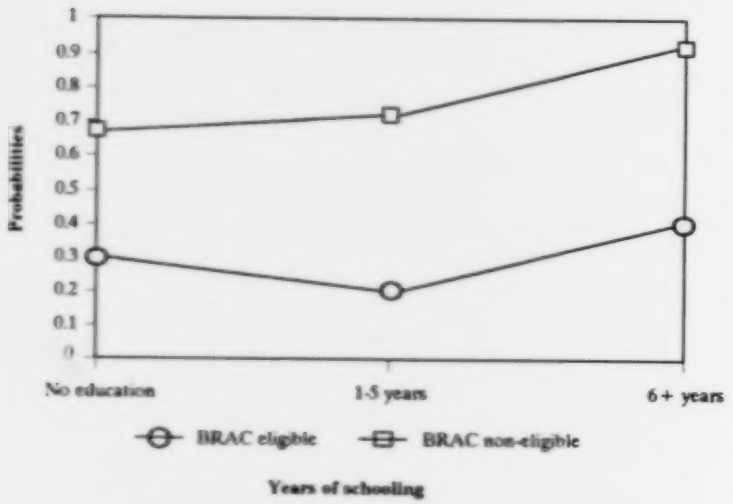
Characteristics	Probabilities
Age 32.4 years; 6+ years of schooling; having 2-4 living children; husband living with wife; and currently having savings and having taken out a loan	0.926
Age 32.4 years; no schooling; 5+ living children; Muslim; husband not living with wife; and currently having taken out no loan and having no savings	0.002
Effect of education for non-Muslim women aged 32.4 years, having 2-4 living children, husband living with them, and currently having savings and having taken out a loan:	
No education	0.661
1-5 years	0.706
6+ years	0.926

Notes: $^{*}p = \exp(x+\Sigma\beta_i x_i)/[1+\exp(x+\Sigma\beta_i x_i)]$.

woman would be employed is small. This finding indicates that there are other characteristics of eligible women that would need to be explored and included in the analysis in order to determine increased probability of being employed. For women aged 31.6 years, having 2-4 living children, currently having savings and having taken out loans and residing in non-BRAC villages, the estimated probabilities corresponding to different levels of education show that 1-5 years of schooling exerts the least contribution on employment. However, the effect of more than six years of schooling increases the probability of employment by about 10 per cent (from 0.403 to 0.303) when compared with that of no education and by about 22 per cent (from 0.403 to 0.180) when compared with 1-5 years of education.

For BRAC-noneligible women, there was a wide range from 0.926 to 0.002, but perhaps the most interesting effects were those associated with women's schooling. For the optimum group of socio-demographic characteristics, i.e. women aged 32.4 years, having 2-4 living children, husband being present, and currently having taken out loans and possessing savings, the effect of education is positive. The effect of more than six years of schooling increases the probability of employment by about 27 per cent (from 0.926 to 0.661), while 1-5 years of schooling increases that probability by about 22 per cent. This indicates that higher levels of education have a demonstrable effect on women's employment when other characteristics are held constant. The accompanying figure illustrates the situation graphically. It is obvious that the non-eligible respondents at all educational levels have higher probabilities of employment than the eligible respondents.

Figure: Estimated probabilities of women's employment by years of schooling, controlling for some selected characteristics in the logit model, Matlab, 1992



Discussion and conclusion

The study demonstrates that as expected women's education has a considerable influence on their socio-demographic aspects of life. Both bivariate and multivariate analyses reflect this notion for BRAC-eligible and non-eligible samples. The results of this study reveal that generally women's education has had a similar impact for both of the BRAC samples corresponding to their different levels of education. Mothers with some schooling have a wider knowledge of the outside world than mothers who have none (LeVine and others, 1991). It is noteworthy that educated mothers are more aware of beneficial health practices and hygiene (Cleland and Ginneken, 1988) and they put more emphasis on cleanliness than do uneducated mothers (Lindenbaum and others, 1985). Besides, it was also observed that women's education could change their attitudes and outlook quite markedly. Mandelbaum (1974:54-55) has given a descriptive account of the effect of education on Indian women:

> An educated woman is usually less closely confined, physically and psychologically, with her husband's family and its narrow familial concerns than is the woman who is brought into their home as an uneducated girl .... She is more likely to feel that she can do something about the condition of pregnancies in close succession or conceiving during her later reproductive years. Her horizons of information are wider, if only by being able to read a newspaper; her network of communication is likely to be broader, if only to school friends beyond the confines of household and kin.

The impact of women's education on employment is quite substantial. The multivariate results suggest that if a woman is educated, she is more likely to be employed outside the house and this likelihood increases with the increase in level of education, particularly for non-eligible women. However, the analysis was unable to incorporate variables for the BRAC-eligible sample which should have been significant in the regression model and thus have increased the estimated probabilities of being employed outside the home. Therefore, further exploration of explanatory variables is required for future research. For the BRAC-noneligible sample, however, significant variables in the model were able to produce a substantial effect on employment, as displayed by the estimated probabilities.

The basic education that women receive can have a variety of positive influences in the home. These range from improvement in time allocation and better health and consumer behaviour to an attitude that is more supportive of family entrepreneurial activities and the education of children. Where the culture allows female participation in employment outside the home, the provision for basic education can have at least as dramatic an effect on the productivity of women as it does on that of men (Cleland, 1990). The educational effectiveness issue is of vital importance since these women are often engaged in small-scale enterprises (e.g. tourist crafts, herding, weaving and so on) that provide a cash contribution to the family's subsistence income (Windham and Chapman, 1990).

This study thus contains several clear policy implications. Providing greater educational opportunities typically leads to lower fertility by giving individuals greater access to information, participation in modern sectors, and new attitudes and values conducive to national development. In this regard, female education has a much larger effect than male education. Therefore, policies should be formulated that would extend opportunities

beyond primary education to the secondary and higher levels of education for females. Bulatao (1984) argues that a sustained commitment to improving educational opportunities over a period of time and the provision of more than minimal education are needed if fertility is to be reduced through this approach. Furthermore, mothers' secondary level of education is associated with their children's likelihood of entering secondary school regardless of urban or rural residence, or the family's economic status (Knodel and Wongsith, 1989). On the other hand, the mechanism of change in the level of fertility also works along the lines that women's engagement in the job market contributes to their marriage delay and increased contraceptive use. Female participation in more formalized activities, which is facilitated by an increase in female educational levels, has a significant negative effect on fertility, resulting from increased use of contraception.

However, the impact of female education may be greatly reduced if it appears to lead nowhere (Ware, 1981). Around the world, education systems seem to be geared to preparing people for scarce civil service positions in towns and cities; in such a setting, a rural woman with some level of education would feel that she has no realistic opportunities in the village to fulfil her goals and aspirations. While it is also clear that there are not enough jobs even in big cities to absorb all the graduates of the national school system, nevertheless, there should be policies that would promote formal education among women and provide them with employment opportunities, especially in countries like Bangladesh, in the area of off-farm activities. Once they become active in income-earning activities and contribute to the economic betterment of their families, their involvement in such activities will in turn lead to socio-economic, health and demographic improvements of the population through intrinsic pathways.

Footnote

1. BRAC-eligible respondents are defined as those who were from a household possessing a land area of less than half an acre and at least one member from that household had sold his/her manual labour for at least 100 days in the one year prior to the survey.

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Projecting Complete Cohort Fertility in Singapore

By Alan Street*

The discussion concerning fertility in Singapore during the post-Second World War period has been confined to consideration of the reduction in total period fertility. Although a focus on period fertility makes good sense in planning for school and university admissions, for maternal and child health care services, for future national service intakes and so on, it is easy, yet potentially misleading, to go one stage further and deduce that since total period fertility has been below the replacement level for a few years, the population is not replacing itself.

Ni Bhrolchain (1992) has provided a trenchant critique of the cohort perspective. It certainly appears that the period approach to fertility analysis, by way of period parity progression rather than through the increasingly discredited total period fertility, is reclaiming some of the ground lost to the cohort perspective advocated by Ryder (1968). However, it seems clear that the question of whether a population is actually replacing itself can be much more effectively answered from a cohort perspective of fertility. It is one of the key aims of this paper to provide such a viewpoint from which Singapore's projected fertility experience can be judged. Obviously, if total period fertility remains below the replacement level for a long period of time, then this fact will eventually be reflected in complete cohort fertility also falling below the replacement level. The question to be addressed in this paper is whether total period fertility has yet been below the replacement level in Singapore long enough for this to be likely to happen in the short- to medium-term future.

In a recent paper, Street (1995) calculated complete cohort fertility rates for 18 generations of Singapore women whose childbearing years from

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age 15 to 44 spanned the post-war period from 1946 to 1992. These cohorts were born between the years 1931 and 1948. In this earlier paper, the concept of partial cohort fertility was suggested as a firm base from which reasonably reliable estimates of future complete cohort fertility could be determined. It is the purpose of the paper to provide these estimates.

At any point in time, for each cohort of women below age 44 (the assumed upper age limit of a woman's childbearing years), partial cohort fertility is defined to be the accumulated achieved cohort fertility from age 15 (the assumed lower age limit of a woman's childbearing years) to the current age. Thus, for example, for women aged n ($n < 44$) in 1992, partial cohort fertility would be:

$$PCF_{n,92} = \sum_{i=15}^{n} ASFR_{i,92-n+i}$$

where, $ASFR_{i,92-n+i}$ is the age-specific fertility rate (ASFR) at age i in the calendar year 1992–n + i.

In Singapore, it is interesting to differentiate these rates by race; although the majority (about 78 per cent) of the population is Chinese, there are significant minorities, namely Malay (about 14 per cent) and Indian (about 7 per cent). The projections in this paper will therefore be made by race as well as for the aggregate population.

Partial cohort fertility in 1992

Partial cohort fertility rates in Singapore for the year 1992 are shown in the accompanying table and graphs. Figure 1 shows partial cohort fertility for the aggregate Singapore population and figure 2 by race.

Table 1: Partial cohort fertility in Singapore, in 1992

1992 age	Race				1992 age	Race			
	Malay	Chinese	Indian	Total		Malay	Chinese	Indian	Total
25	0.918	0.300	0.595	0.436	35	2.185	1.654	1.901	1.748
26	1.117	0.444	0.768	0.590	36	2.263	1.732	2.063	1.822
27	1.247	0.584	0.909	0.727	37	2.242	1.807	2.181	1.888
28	1.427	0.758	1.149	0.904	38	2.403	1.870	2.262	1.968
29	1.587	0.903	1.317	1.055	39	2.417	1.933	2.158	2.009
30	1.744	1.080	1.403	1.219	40	2.486	2.015	2.266	2.095
31	1.909	1.233	1.534	1.369	41	2.520	2.023	2.427	2.112
32	1.992	1.341	1.617	1.468	42	2.580	2.080	2.665	2.180
33	2.060	1.459	1.665	1.567	43	2.563	2.146	2.778	2.236
34	2.135	1.560	1.780	1.664					

Figure 1: Partial cohort fertility in Singapore: aggregate population in 1992

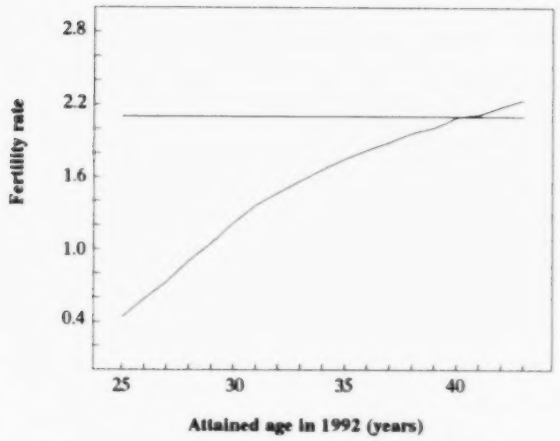
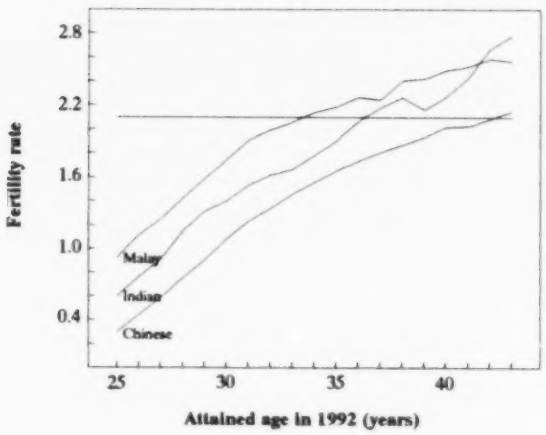


Figure 2: Partial cohort fertility in Singapore: by race, in 1992



It has been shown by Street (1995) that, up to and including 1992, no cohorts had completed their childbearing with fewer than 2.1 children on average and that this is true not only for Singapore's population as a whole but also for the three racial groups considered separately. But the question remains regarding those cohorts who were still within their childbearing years at the end of 1992. How can we best project complete cohort fertility for these women? In fact, the question to be addressed in this paper is somewhat less ambitious than this. Our attention will be focused only on the 10 further cohorts who were aged from 34 to 43 years in 1992.

For any such projection, it would seem sensible to base the estimates on as much firm data as it is possible to obtain. It follows that, since partial cohort figures are already available for the cohorts aged between 34 and 43 at the end of 1992, in order to predict the complete cohort fertility for these women, all that is needed are the following estimates, using as before the notation $ASFR_{i,j}$ to denote the age-specific rate at age i in calendar year j:

Cohort year of birth	Further estimates necessary for complete cohort fertility to be projected
1949	$ASFR_{44,93}$
1950	$ASFR_{43,93} + ASFR_{44,94}$
1951	$ASFR_{42,93} + ASFR_{43,94} + ASFR_{44,95}$
...	... ...
...	... ...
1958	$ASFR_{35,93} + ASFR_{36,94} + ASFR_{37,95} + ... + ASFR_{44,02}$

It is clear, therefore, that in order to project complete cohort fertility for the next 10 generations of females, it is necessary to estimate certain period fertility rates over the next 10 years. However, the only estimates necessary will be of period fertility (at single ages) ranging from estimates for ages 35 to 44 for the year 1993, to an estimate for age 44 for the year 2002. The appropriate sums shown in the above array would then be added to the corresponding 1992 partial cohort fertility rates to obtain projections of complete cohort fertility for the 10 further cohorts.

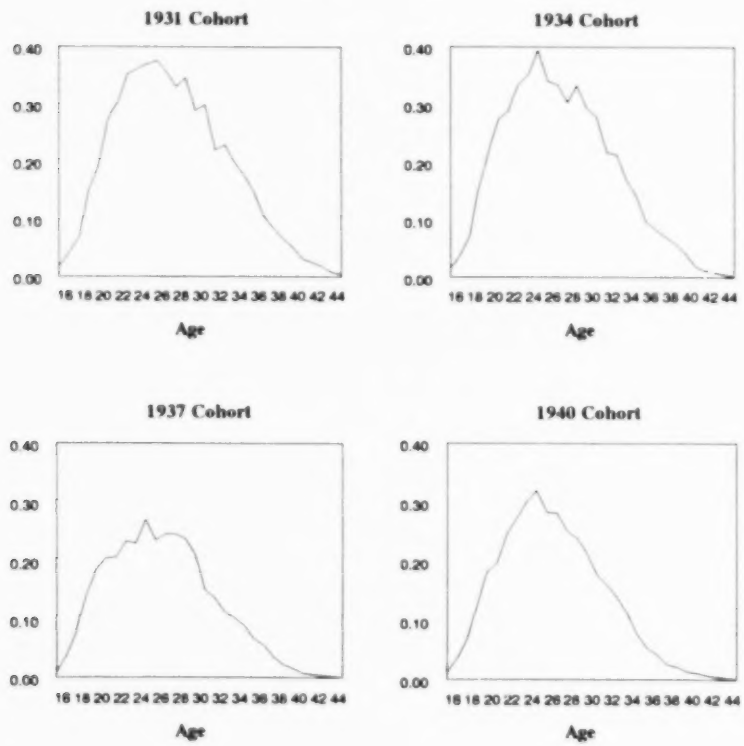
Projecting fertility

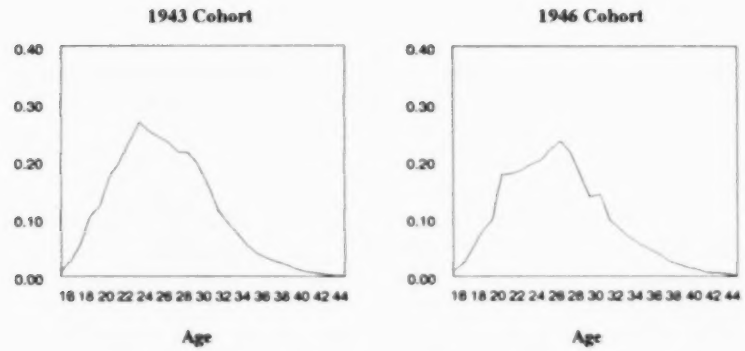
Much research has been done on attempting to develop a general mathematical formulation for the fertility curve. Probably the best known models are Brass's Modified Gompertz Method (1980) and Coale and

Trussel's Model Fertility Curves (1974). However, the aim in the present paper is much more mundane than to try to develop a general mathematical model for "fertility"; it is rather to establish a mathematical representation that appears to be suitable for the limited projection of the specific data that are available on Singapore.

The projection function

The following graphs indicate that period fertility would appear to be much more amenable than cohort fertility to such modelling. The first series of six graphs show typical aggregate population cohort fertility curves, from which it will be seen that it would be difficult indeed to try to develop a general mathematical expression for Singapore's cohort fertility. The curves show a definite skewness to the right but little smoothness.

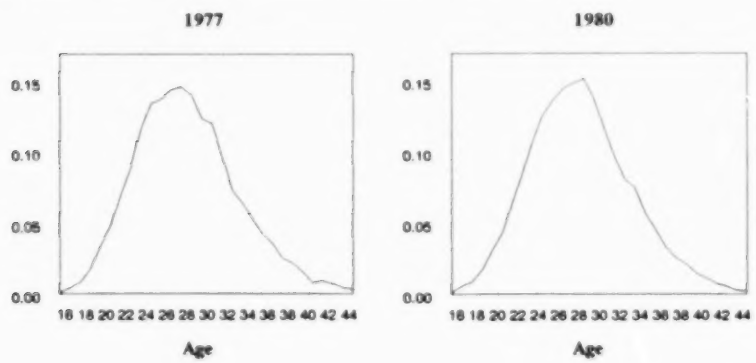


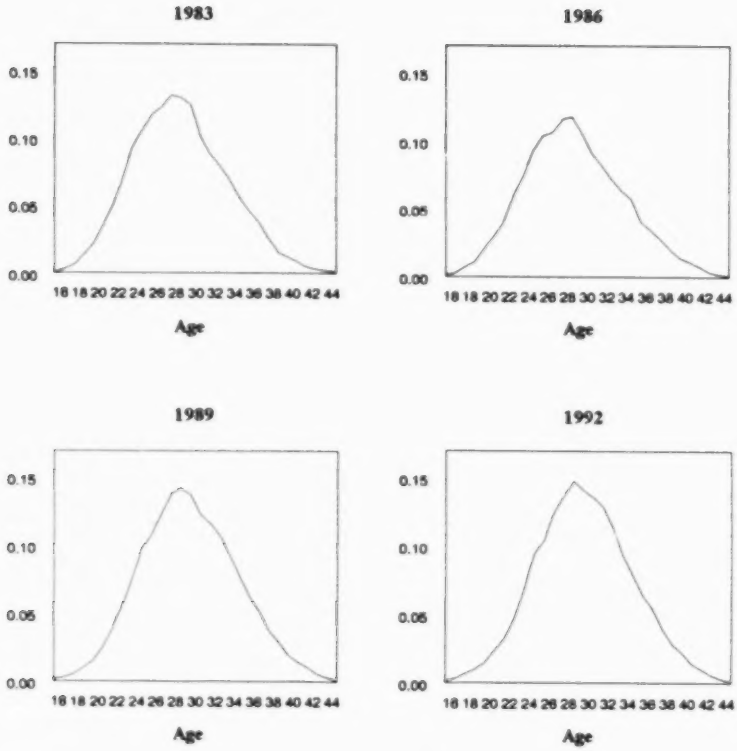


However, if the curves of total period fertility are considered, it will be seen from the following six plots that as the fertility-weighted average age has increased over the past 15 years, so the fertility curve has become more symmetrical although there is still a slight tendency for skewness to the right. It will also be observed that the graphs show a much more well-behaved appearance and could possibly be approximated by some form of mathematical expression. But which mathematical function should be chosen?

The first attempt was to fit a log-normal distribution to the data. Figure 3 (page 66) shows a log-normal curve fitted to the 1992 aggregate population fertility data with the actual fertility rates plotted as "+" signs.

For the central ages from about 20 to 40, the fit is quite good, but at the extreme ages the fitted log-normal distribution understates fertility at the youngest ages and overstates it at the highest ages.





It is clear that the fit at the extreme ages needs to be improved and the next step would be to observe what sort of fit a normal distribution would provide. Figure 4 (page 66) shows a normal curve fitted to the same 1992 aggregate population data.

Here, for the extreme ages at 20 and below and at 40 and above, the normal fit is quite good, but at the central ages the normal curve understates fertility for ages up to the mode of the actual fertility distribution and overstates it for ages above the mode.

These same general characteristics are also apparent in the fitted normal and log-normal curves to the 1992 data for the three racial groups as the graphs on page 67 show.

Figure 3: Fitted log-normal curve with actual fertility plots: aggregate population of Singapore, 1992 data

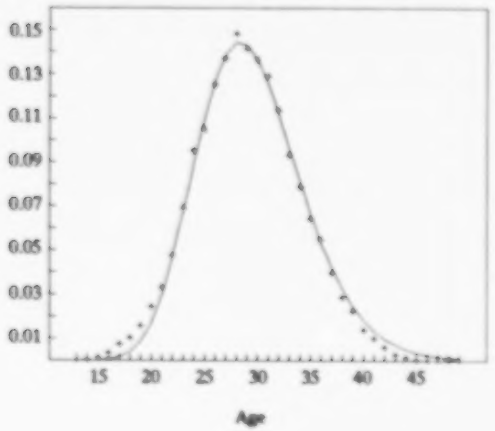
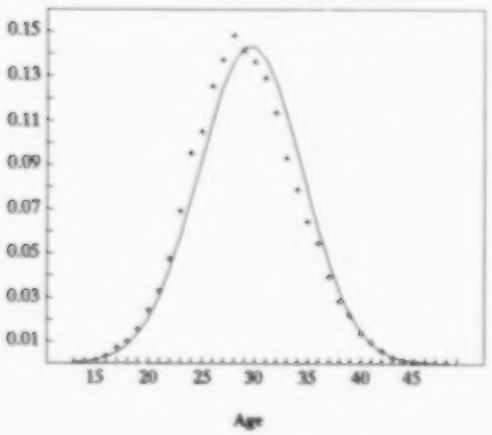
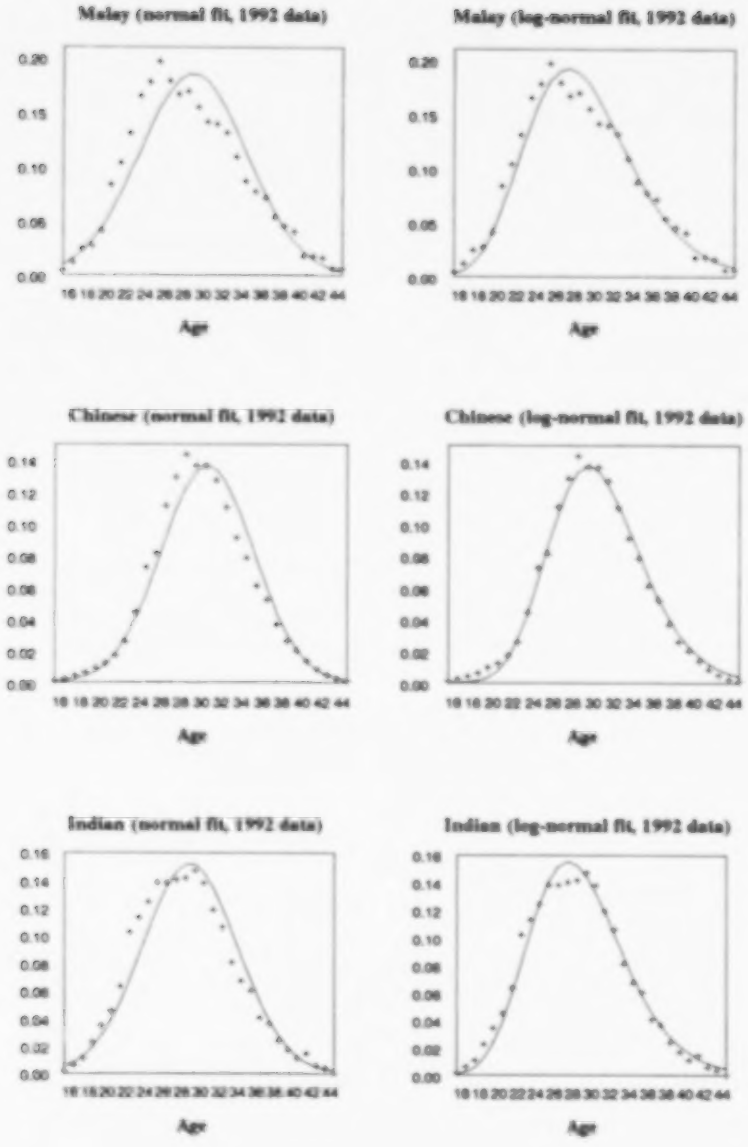


Figure 4: Fitted normal curve with actual fertility plots: aggregate population of Singapore, 1992 data



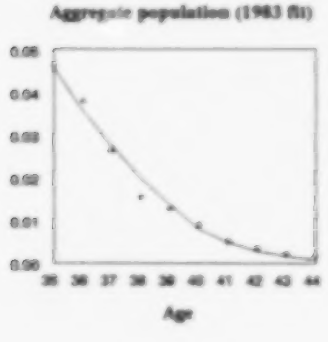

Malay (normal fit, 1992 data)
Malay (log-normal fit, 1992 data)
Chinese (normal fit, 1992 data)
Chinese (log-normal fit, 1992 data)
Indian (normal fit, 1992 data)
Indian (log-normal fit, 1992 data)
Age

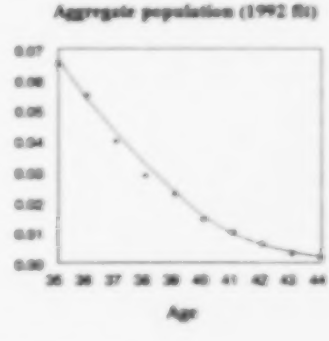
It will be recalled from what was mentioned previously that, in order to project complete cohort fertility for the next 10 cohorts of women, only estimates are required of period fertility at ages $35+t$ to 44 in each of the years $1993+t$ to 2002, respectively, where $0 \leq t \leq 9$. Thus, focus is on the fertility curve in its final one-third range, where for all races, as has been seen, it seems to tend towards normality. However, the approach to normality differs between the aggregate population and between the three races. The fertility curves for Malays and Indians appear to become more or less normal at ages 35 and above, whereas those for the Chinese and for the aggregate population tend to follow the log-normal curve until the late thirties and the normal curve thereafter.

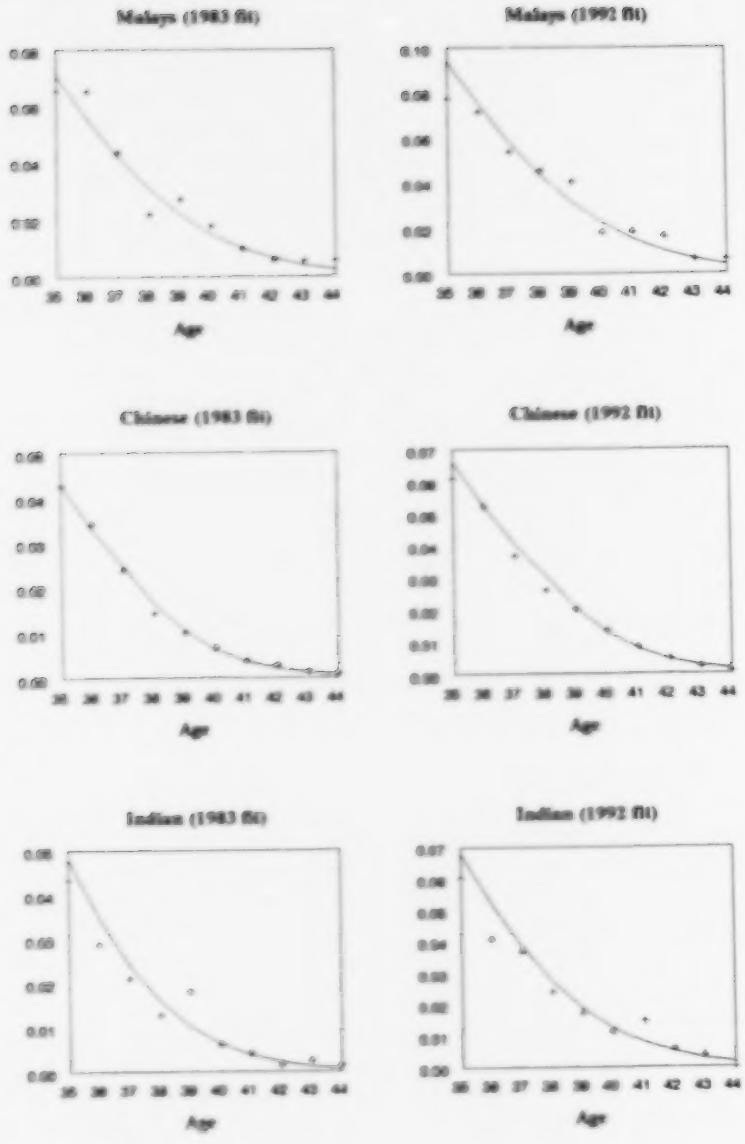
For the purposes of the projections for the period 1993 to 2002, it was assumed that, at all ages from 35 to 44, the normal curve provided a suitable model for Malay and Indian fertility. For the Chinese, it was assumed that the log-normal curve was appropriate to age 37 and the normal curve thereafter. For the aggregate population, it was assumed that the normal curve was appropriate for ages from 40 to 44, but that from 35 to 39 a blend of the normal and log-normal curves would be more suitable. After some trial and error, coefficients of $(t/5)^2$ and $1 - (t/5)^2$ at age $35+t$ $(0 \leq t \leq 4)$ were adopted for the normal and log-normal components, respectively.

These fitted curves, together with actual fertility rates at ages 35 and above, are shown in the following graphs for the aggregate population and the three racial groups for the years 1983 and 1992. It should perhaps be mentioned at this point that all the curves here were fitted by the method of moments.

It is noticeable that in both years illustrated, there is a broad improvement in the quality of the fit as the population size increases from Indian to Malay to Chinese to the aggregate population.






Malays (1983 fit)
Malays (1992 fit)
Chinese (1983 fit)
Chinese (1992 fit)
Indian (1983 fit)
Indian (1992 fit)
Age

The projections parameters

Having decided upon the general shapes to be adopted for the projection of the various racial and aggregate population fertility curves, the next step is to project the various parameters that are required. The first requirement here is estimates of total period fertility for the three racial groups and the aggregate population for the 10 years from 1993 to 2002. The second requirement is to give consideration to the necessary parameters for the projected normal and log-normal probability distributions.

Projected total period fertility

There has been a small but definite increase in total period fertility since the Government's new population policy was introduced (Yap, 1995). In 1992, total period fertility stood at 2.60, 1.56, 1.95 and 1.76 for the Malays, Chinese, Indian and aggregate population, respectively.

Projections were made on three bases for total period fertility. Firstly, it was assumed that for the next 10 years it would remain at these 1992 levels. Secondly, and rather more optimistically (at least for the Indians and Chinese), it was assumed that for each racial group total period fertility would approach 2.1 linearly over a 20-year period. Thirdly, and perhaps unrealistically optimistic, it was assumed that each race would achieve the 2.1 level in 10 years. It should be pointed out that, for the Malays, the second and third of these assumptions imply declining total period fertility.

Projected model parameters

The first assumption regarding fertility-weighted average age was that, for each race, it would remain at the same level as in 1992, namely at 27.95, 29.59, 27.97 and 29.08 years for the Malays, Chinese, Indians and aggregate population, respectively. Since 1986, however, all races have shown an increase in fertility-weighted average age; respective mean annual increments of about 0.05, 0.16, 0.03 and 0.14 years have been experienced. The second assumption was that these annual increases would continue until 2002.

For the Malays, the standard deviation of the fertility schedule has increased by an average annual amount of about 0.014 since 1986. The Chinese, Indian and aggregate population standard deviations have, however, shown reductions over this period by 0.033, 0.010 and 0.022 per annum

on average, respectively. The first projection basis for standard deviations was to assume that they remained at their 1992 levels until 2002, and the second was that each year they changed by these same 1986-1992 average amounts.

The log-normal parameters for the Chinese and aggregate population projections were selected to be consistent with these average ages and standard deviations.

Therefore, there are 12 separate projections as follows: (three fertility assumptions) x (two mean age assumptions) x (two standard deviation assumptions).

Total period fertility (TPF) (1)	Fertility-weighted mean age (2)	Standard deviation of fertility-weighted age (3)
1992 TPF	1992 mean ages	1992 standard deviations
TPF to 2.10 by year 2012	Mean ages increasing by 1986-1992 average	Standard deviations changing by 1986-1992 average
TPF to 2.10 by year 2002		

Projection results

The results of the projections on these 12 bases are shown below with the notation A/B/C denoting a projection using bases A, B and C from columns (1), (2) and (3) of the tableau immediately above, respectively.

For the Malays, certain of the parameter assumptions are significantly different from those for the other races. Firstly, unlike for the Chinese and Indians, progress of total period fertility towards the replacement level implies a reduction in fertility rates since the Malay rate in 1992 was 2.60; thus, all projections other than $P_{1.1}$, $P_{2.1}$, $P_{3.1}$ and $P_{4.1}$ assume declining fertility for the Malays. Secondly, projections $P_{3.1}$ to $P_{4.3}$ assume a "changing" standard deviation of the fertility curve. For the Malays, this implies an increasing standard deviation whereas for the other races the standard deviation is assumed to decline.

Additions to 1992 partial cohort fertility projection $P_{1.1}$: basis 1/4/6

1992 age	Malay	Chinese	Indian	Total
34	0.356	0.236	0.232	0.252
35	0.263	0.172	0.164	0.186
36	0.188	0.120	0.113	0.133
37	0.131	0.080	0.075	0.090
38	0.088	0.049	0.048	0.058
39	0.056	0.029	0.029	0.035
40	0.035	0.016	0.017	0.020
41	0.020	0.008	0.009	0.011
42	0.010	0.004	0.004	0.005
43	0.004	0.001	0.002	0.002

Additions to 1992 partial cohort fertility projection $P_{1.2}$: basis 2/4/6

1992 age	Malay	Chinese	Indian	Total
34	0.345	0.250	0.235	0.260
35	0.255	0.180	0.166	0.191
36	0.183	0.125	0.114	0.136
37	0.127	0.083	0.075	0.093
38	0.086	0.051	0.048	0.059
39	0.055	0.030	0.029	0.036
40	0.034	0.017	0.017	0.021
41	0.019	0.009	0.009	0.011
42	0.010	0.004	0.004	0.005
43	0.004	0.001	0.002	0.002

Additions to 1992 partial cohort fertility projection $P_{1.3}$: basis 3/4/6

1992 age	Malay	Chinese	Indian	Total
34	0.334	0.263	0.237	0.268
35	0.247	0.189	0.168	0.197
36	0.178	0.131	0.115	0.140
37	0.124	0.086	0.076	0.095
38	0.084	0.053	0.048	0.061
39	0.054	0.031	0.029	0.036
40	0.033	0.017	0.017	0.021
41	0.019	0.009	0.009	0.011
42	0.010	0.004	0.004	0.005
43	0.004	0.001	0.002	0.002

Additions to 1992 partial cohort fertility projection $P_{2.1}$: basis 1/5/6

1992 age	Malay	Chinese	Indian	Total
34	0.376	0.291	0.240	0.299
35	0.277	0.210	0.170	0.220
36	0.198	0.146	0.117	0.156
37	0.138	0.097	0.077	0.106
38	0.092	0.060	0.049	0.068
39	0.059	0.035	0.030	0.041
40	0.036	0.019	0.017	0.023
41	0.021	0.010	0.009	0.012
42	0.010	0.004	0.004	0.006
43	0.004	0.001	0.002	0.002

Additions to 1992 partial cohort fertility projection $P_{2.2}$: basis 2/5/6

1992 age	Malay	Chinese	Indian	Total
34	0.364	0.308	0.243	0.309
35	0.269	0.221	0.172	0.227
36	0.193	0.153	0.118	0.161
37	0.134	0.101	0.078	0.109
38	0.090	0.062	0.050	0.070
39	0.058	0.036	0.030	0.042
40	0.036	0.020	0.017	0.024
41	0.020	0.010	0.009	0.013
42	0.010	0.004	0.004	0.006
43	0.004	0.001	0.002	0.002

Additions to 1992 partial cohort fertility projection $P_{2.3}$: basis 3/5/6

1992 age	Malay	Chinese	Indian	Total
34	0.352	0.325	0.245	0.320
35	0.260	0.233	0.174	0.234
36	0.187	0.160	0.119	0.165
37	0.130	0.105	0.079	0.112
38	0.088	0.065	0.050	0.071
39	0.057	0.038	0.030	0.043
40	0.035	0.021	0.018	0.024
41	0.020	0.010	0.009	0.013
42	0.010	0.005	0.004	0.006
43	0.004	0.002	0.002	0.002

Additions to 1992 partial cohort fertility projection $P_{3.1}$: basis 1/4/7

1992 age	Malay	Chinese	Indian	Total
34	0.363	0.225	0.228	0.242
35	0.269	0.162	0.161	0.178
36	0.193	0.112	0.110	0.127
37	0.134	0.074	0.073	0.086
38	0.090	0.046	0.046	0.055
39	0.058	0.027	0.028	0.033
40	0.036	0.015	0.016	0.019
41	0.020	0.008	0.009	0.010
42	0.010	0.004	0.004	0.005
43	0.004	0.001	0.002	0.002

Additions to 1992 partial cohort fertility projection $P_{3.2}$: basis 2/4/7

1992 age	Malay	Chinese	Indian	Total
34	0.352	0.236	0.231	0.250
35	0.261	0.169	0.163	0.183
36	0.187	0.117	0.112	0.130
37	0.131	0.077	0.074	0.088
38	0.088	0.047	0.047	0.057
39	0.057	0.028	0.029	0.034
40	0.035	0.015	0.017	0.020
41	0.020	0.008	0.009	0.010
42	0.010	0.004	0.004	0.005
43	0.004	0.001	0.002	0.002

Additions to 1992 partial cohort fertility projection $P_{3.3}$: basis 3/4/7

1992 age	Malay	Chinese	Indian	Total
34	0.340	0.247	0.233	0.257
35	0.253	0.177	0.165	0.188
36	0.182	0.122	0.113	0.134
37	0.127	0.080	0.074	0.090
38	0.086	0.049	0.047	0.058
39	0.056	0.029	0.029	0.035
40	0.034	0.016	0.017	0.020
41	0.020	0.008	0.009	0.011
42	0.010	0.004	0.004	0.005
43	0.004	0.001	0.002	0.002

Additions to 1992 partial cohort fertility projection $P_{4.1}$: basis 1/5/7

1992 age	Malay	Chinese	Indian	Total
34	0.384	0.275	0.236	0.287
35	0.283	0.197	0.167	0.211
36	0.203	0.136	0.114	0.149
37	0.141	0.090	0.075	0.101
38	0.095	0.055	0.048	0.065
39	0.061	0.032	0.029	0.039
40	0.037	0.018	0.017	0.022
41	0.021	0.009	0.009	0.012
42	0.011	0.004	0.004	0.006
43	0.004	0.001	0.002	0.002

Additions to 1992 partial cohort fertility projection $P_{4.2}$: basis 2/5/7

1992 age	Malay	Chinese	Indian	Total
34	0.371	0.290	0.239	0.297
35	0.275	0.207	0.169	0.217
36	0.197	0.143	0.115	0.154
37	0.137	0.094	0.076	0.104
38	0.092	0.057	0.048	0.066
39	0.060	0.033	0.029	0.040
40	0.036	0.018	0.017	0.023
41	0.021	0.009	0.009	0.012
42	0.010	0.004	0.004	0.006
43	0.004	0.001	0.002	0.002

Additions to 1992 partial cohort fertility projection $P_{4.3}$: basis 3/5/7

1992 age	Malay	Chinese	Indian	Total
34	0.358	0.305	0.241	0.307
35	0.266	0.217	0.171	0.224
36	0.192	0.149	0.117	0.158
37	0.134	0.097	0.077	0.106
38	0.090	0.059	0.049	0.068
39	0.058	0.035	0.030	0.040
40	0.036	0.019	0.017	0.023
41	0.020	0.010	0.009	0.012
42	0.010	0.004	0.004	0.006
43	0.004	0.001	0.002	0.002

Interpreting the projections

For the Chinese and the aggregate population, the order of the projections going from highest to lowest is:

$$P_{2.3} > P_{2.2} > P_{4.3} > P_{2.1} > P_{4.2} > P_{4.1} > P_{1.3} > P_{1.2} > P_{3.3} > P_{1.1} > P_{3.2} > P_{3.1} \quad (1)$$

For the Indians, the order is identical except that $P_{4.1}$ and $P_{1.3}$ are interchanged.

For the Malays, the order is different, reflecting the points mentioned above. The order of the projection is as follows:

$$P_{4.1} > P_{2.1} > P_{4.2} > P_{2.2} > P_{3.1} > P_{4.3} > P_{1.1} > P_{3.2} > P_{2.3} > P_{1.2} > P_{3.3} > P_{1.3} \quad (2)$$

However, there are similarities between (1) and (2). It will be observed that $P_{4.1}$, $P_{4.2}$ and $P_{4.3}$ appear in the upper half of both (1) and (2), as also does $P_{2.2}$. Similarly, $P_{1.1}$, $P_{1.2}$, $P_{1.3}$, $P_{3.2}$ and $P_{3.3}$ all appear in the lower half of (1) and (2).

The Chinese, Indians and aggregate population

If groups of projections are denoted as G1 = ($P_{1.1}$, $P_{1.2}$, $P_{1.3}$), G2 = ($P_{2.1}$, $P_{2.2}$, $P_{2.3}$), G3 = ($P_{3.1}$, $P_{3.2}$, $P_{3.3}$) and G4 = ($P_{4.1}$, $P_{4.2}$, $P_{4.3}$), it is obvious that within any group, $P_{n.3}$ is greater than $P_{n.2}$ and $P_{n.2}$ is greater than $P_{n.1}$ since the only parameter which is changing is a reducing total period fertility assumption from $P_{n.3}$ to $P_{n.2}$ to $P_{n.1}$.

Most relationships between $P_{n.k}$ and $P_{m.k}$ can easily be explained by considering the nature of the parameters which change from one to the other. For example, $P_{1.1}$ is greater than $P_{3.1}$ since the only difference here is a declining standard deviation which will reduce the spread of the fertility distribution in the second projection and thus reduce the projected rates at the older ages. The only one of these relationships which calls for particular mention is that between G1 and G4. Going from G1 to G4, fertility values are simultaneously being increased with a higher average age and reduced with a smaller standard deviation. As will be evident, the reduction due to the declining standard deviations is more than offset by the increasing average age assumption since $P_{4.1}$ is greater than $P_{1.1}$, $P_{4.2}$ is greater than $P_{1.2}$ and $P_{4.3}$ is greater than $P_{1.3}$.

More interesting are certain comparisons between $P_{n.k}$ and $P_{m.j}$ where $k \neq j$. For example, consider $P_{1.3}$ and $P_{2.1}$. Here, the first assumes an increase of total period fertility to the replacement level within 10 years, the average age and standard deviation remaining at 1992 levels. The second, however, assumes an increase in average age with total period fertility and

standard deviation constant at their 1992 values. It is perhaps surprising that $P_{2.1}$ is greater than $P_{1.3}$, indicating that an increase in average age can outweigh a fairly rapid rise in total period fertility.

Even more notable is the fact that $P_{4.1}$ is greater than $P_{1.3}$, since even with the reduction in $P_{4.1}$ that will result from the inclusion of a declining standard deviation assumption, it is still higher than the G1 projection with the highest fertility rates.

The Malays

Because of the different nature of the assumptions made for the Malays, the relationship between various projections requires a modified interpretation. Here, within any group we shall have $P_{n.1}$ being greater than $P_{n.2}$ and $P_{n.2}$ being greater than $P_{n.3}$ because of the declining fertility assumption. On the other hand, the assumed increases in both average age and in standard deviation will have the effect of inflating projected fertility rates.

Particularly noteworthy for the Malays is the fact that $P_{4.3}$ is greater than $P_{1.1}$, showing again that, despite a rapidly declining total period fertility rate reducing to 2.1 in 10 years, the increasing average age and standard deviation assumed in $P_{4.3}$ still places it ahead of $P_{1.1}$ which assumes continuation of the 1992 status quo.

Projected complete cohort fertility

If these projected values are added to the partial cohort fertility rates given in the section of this paper under the subheading "partial cohort fertility in 1992" on pages 60-62, we shall obtain projected values of complete cohort fertility for 10 further cohorts of women. In order to provide an idea of the range within which these projections lie, the following table and graphs show projected values of complete cohort fertility for each race and for the aggregate population on two bases: firstly "high", on the highest of the projections given above in the section under the subheading "projecting fertility" starting on page 62 and secondly "low", on the lowest. Provided that Singapore's total period fertility does not actually decline within the 35 to 44 age group over the next 10 years, which is probably unlikely, the actual outcomes for the Chinese, the Indians and the aggregate population should be within the range of the two values shown.

On the other hand, if Malay total period fertility increases rather than remaining the same or reducing, the actual outcomes could be higher than those shown.

Table 2: Projected complete cohort fertility: cohorts born in Singapore from 1948 to 1958

Year born	Malay		Chinese		Indian		Total	
	High	Low	High	Low	High	Low	High	Low
1948	2.745	2.745	2.259	2.259	2.800	2.800	2.354	2.354
1949	2.567	2.567	2.147	2.147	2.779	2.779	2.238	2.238
1950	2.591	2.590	2.084	2.083	2.669	2.669	2.186	2.185
1951	2.541	2.539	2.033	2.031	2.436	2.435	2.125	2.123
1952	2.523	2.519	2.036	2.030	2.283	2.282	2.119	2.114
1953	2.478	2.471	1.970	1.959	2.188	2.186	2.051	2.042
1954	2.497	2.486	1.934	1.915	2.312	2.308	2.039	2.023
1955	2.384	2.366	1.912	1.881	2.260	2.254	2.000	1.974
1956	2.466	2.441	1.892	1.844	2.182	2.174	1.987	1.949
1957	2.468	2.432	1.887	1.816	2.074	2.062	1.982	1.926
1958	2.518	2.468	1.885	1.785	2.025	2.008	1.983	1.906

The first point that should be mentioned here is that this table and the graphs shown hereafter include complete cohort fertility for the 1948 cohort. According to our definition of cohort fertility, this cohort had already completed its childbearing at the end of 1992. However, it has been included in order to provide a known starting point for the projected values.

As far as the aggregate population is concerned, the next four cohorts, i.e. those born from 1949 to 1952, should achieve the replacement level of complete cohort fertility.

For the aggregate population, the 1953 cohort shows a significant reduction compared with the 1952 cohort and thereafter projected complete cohort fertility continues to decline: to a low for the 1957 cohort of 1.982 on the "high" projection or reducing throughout on the "low" basis to 1.906 for the 1958 cohort.

For the Malays, even on the "low" basis, all cohorts are projected to complete childbearing with complete cohort fertility well above the replacement level. The rates decline to a low point of around 2.37 for the cohort born in 1955 and then begin to increase again. A noticeable feature of the rates is the small difference between most of the "low" and "high" projections.

Figure 5: Projected complete cohort fertility: aggregate population of Singapore, cohorts born from 1948 to 1985

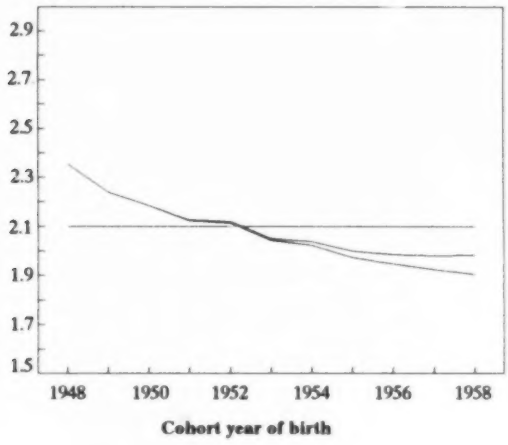


Figure 6: Projected complete cohort fertility: Malay cohorts in Singapore born from 1948 to 1958

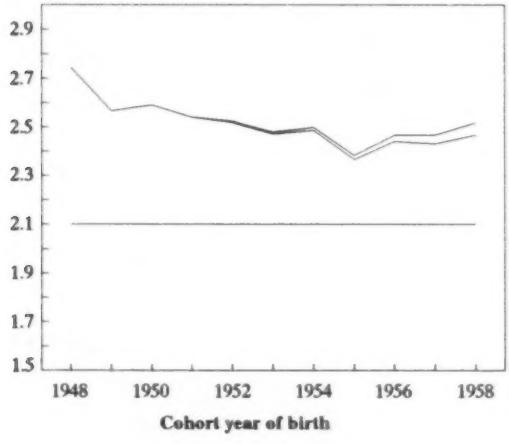


Figure 7: Projected complete cohort fertility: Chinese cohorts in Singapore born from 1948 to 1958

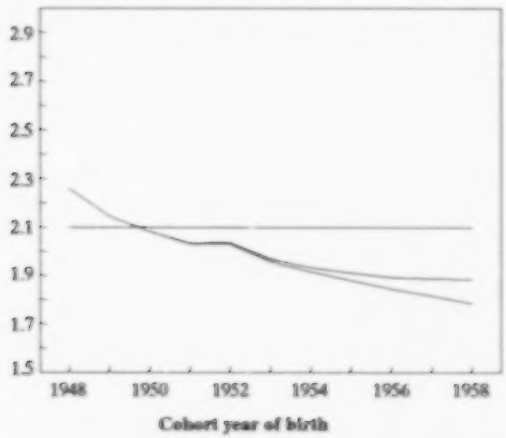
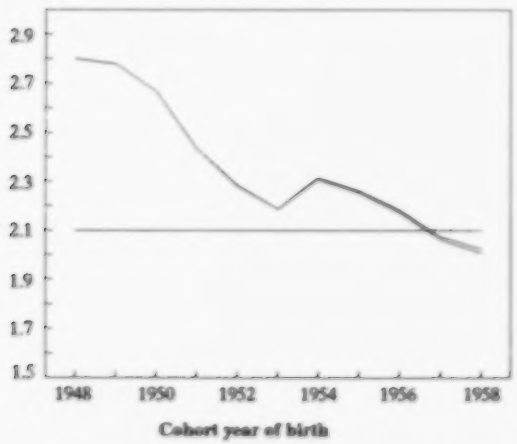


Figure 8: Projected complete cohort fertility: Indian cohorts in Singapore born from 1948 to 1958



In stark contrast to that of the Malays, Chinese complete cohort fertility appears set to remain above the replacement level for only one further cohort: the 1949 generation of women. Therefore for the Chinese, even with the most optimistic of scenarios, namely a total period fertility rate increasing to 2.1 by the year 2002 and an increasing fertility-weighted average age, it would appear inevitable that not only will complete cohort fertility fall below the replacement level for the cohorts born after 1949, but also it is likely to remain at that level for a good number of years. There is a hint that, on the "high" basis, it could perhaps reach a minimum for the 1958 cohort but on the "low" basis, which assumes a continuation of 1992 total period fertility, no increase in fertility-weighted average age and a continuing decline in standard deviations, the situation would appear to be bleak indeed for a return to a replacement level of complete cohort fertility even in the medium-term future.

This "low" scenario is, however, probably too pessimistic. Not only does it assume a continuation of total period fertility at its 1992 level (not in itself an unreasonable proposition viewed in the context of the relatively static Chinese experience over the past 15 or so years) but also a reducing standard deviation of the fertility curve without an accompanying increase in fertility-weighted average age. Under present circumstances, the combination of these last two features is unlikely. Thus, the "low" curve should be viewed here, and indeed for the Indian and aggregate populations as well, as the minimum values for complete cohort fertility below which, barring any reductions in total period fertility, it is most unlikely to fall.

It will be noted that, by the time the 1958 cohort reaches age 44, the difference between the Malay "high" and "low" curves is only about 2 per cent. For the Chinese, however, the difference is somewhat larger at 5.5 per cent. In Redington's (1952) graphic terms, the "funnel of doubt" is expanding far more quickly for the Chinese.

A striking feature of the Indian graph is the virtual absence of any funnel at all: the funnel of doubt seems to have been transformed into a narrow passageway of certainty. This feature is a refection of the traditionally small proportion of Indian complete cohort fertility which is contributed by the late phase and which is projected to continue over the next 10 years. It will be observed that, on any of the projection bases above, Indian complete cohort fertility will reduce to below the replacement level for the 1957 cohort.

Theoretical, policy and programme issues

The aim of this paper has been to describe one way in which complete cohort fertility rates may be projected into the future, with the underlying purpose, essentially, of addressing the issue of population replacement. It is certainly not claimed that this is the only way or indeed necessarily the best way to make such projections but, based as it is on the secure foundation of partial cohort fertility, it possesses the advantage of being grounded in objectively determined past fertility performance. The extent to which the projections are wrong can only be equal to the extent to which projections of single-age fertility rates for ages 35 to 44 next year, to age 44 in 10 years' time, can be wrong. They always will be wrong, of course, but the final decade of the childbearing years tends to be the least significant. Moreover, the method has the advantage that the further one projects into the future, the smaller are the number of fertility rates required. Therefore, the extent of any error should be small.

This concluding section of the paper seeks to justify the use of cohort fertility measures in the approach to answering questions concerning population replacement and ends with a very brief review, for those who feel that they might like to adopt the general approach outlined here, of some practical issues and of a method that could be used where the available data are not as comprehensive as they are in Singapore.

Why cohort fertility? – the replacement issue

Virtually all published information on fertility in Asia refers to period fertility. There are good reasons for this. Not only are cohort measures much more troublesome to calculate but in many, if not most ways, policy makers and planners will, as already mentioned, be far more concerned with the trend of total period fertility, or probably more accurately, with the number of births, from year to year.

What purpose does the measurement of cohort fertility serve? According to Ni Bhrolchain (1992), very little apparently. However, quite apart from its intrinsic interest, it could be argued that, at least when considering the replacement question, cohort fertility gives a greater insight than does total period fertility into whether a population's fertility experience has been adequate to achieve replacement. It is, therefore, with this replacement issue in mind that this paper has been written.

In Singapore before the mid-1970s and in many Asian countries today, it could be safely inferred from period fertility schedules that the population's experience was sufficient to achieve replacement – total period

fertility of above 3 per annum coupled with moderate levels of mortality can safely be assumed to generate sufficient births to ensure replacement. The problem arises when total period fertility falls to below the replacement level (assumed in a low mortality environment to be 2.10) as it has been in Singapore since 1976.

It is in fact meaningless to ask: "At the **present** fertility level, is the population replacing itself?" And this is true whether or not the answer is expressed in terms of total period fertility or complete cohort fertility. In the period domain, the current year's total period fertility experience tells us little or nothing about replacement, influenced as it can be by timing distortions caused perhaps by incentives or disincentives introduced by the authorities to influence fertility levels, or, as in Chinese communities, by whether the current year happens to be the "Year of the Dragon" which is considered particularly auspicious for having children or the "Year of the Tiger" which is considered inauspicious for having girls, as discussed by Saw (1990). However, it is obviously equally as erroneous to declare on the basis of the complete cohort fertility of those women who have just attained the age of 45 that the population is or is not replacing itself. What we can say of relevance about these women however – and this is an objective fact – is whether or not they have, as a cohort, produced sufficient children to replace themselves.

It is over time that the replacement of a population will occur and it is therefore only over time that an answer to the replacement question may be suggested. This obviously requires an averaging of fertility rates over a period of years. It can be claimed that the average of the past 2N years total period fertility will provide a satisfactory answer. However, there are three problems with this approch: two theoretical and one practical. Firstly, it is necessary to think carefully about what is being averaged. The question of population replacement is a question of whether on average real cohorts are replacing themselves. Why then use the synthetic cohort approach of the period method if data on real cohorts are available? Secondly, any averaging over the past 2N years will be centred at a time N years ago. While a larger value of 2N will clearly tend to reduce the influence of the type of period distortions mentioned above, it will, however, at the same time reduce the immediacy and relevance of the resulting number by removing it further back in time from current experience. Thirdly, it is worth pointing out how misleading in practice such an average can be; over the 20 years from 1974 to 1993, the average of annual total period fertility for Singapore's aggregate population has been 1.79, i.e. well below the replacement level, yet, as we have seen, no cohorts have yet completed their childbearing with fewer than

2.1 children. Therefore, historical total period fertility averages appear to be of little value when addressing the replacement issue.

It would seem that a far more promising approach is to take the average of successive complete cohort fertility rates over a period of 2N years starting N years ago. These values will be for the N cohorts who have most recently completed their childbearing together with the projected values for the next N cohorts to do so. Such an average will be centred at the present time and will, moreover, comprise the actual and reliably projected lifetime reproductive performance of real cohorts of women, which is after all the fundamental component of the process by which a population replaces itself.

A further advantage of the cohort approach, and the use in particular of partial cohort rates, is that, for those cohorts of women still within the childbearing years, it is a simple matter to show what future fertility performance from each cohort is necessary in order that they will achieve the replacement level. In this way it is possible to assess informally, in the light of past experience and without the need to perform projections, how likely this would be.

Practical problems

While in many Asian and Pacific societies total period fertility rates are certainly well above the replacement level, the success of the family planning movement in others, for example Australia, China, Hong Kong, Japan, New Zealand, the Republic of Korea, Singapore and Thailand, has taken the total period fertility rate to a level of 2.1 or lower. In these societies and in others where total period fertility is beginning to approach the replacement level, concern will quite naturally turn at some stage to the question of replacement and to the longer term prospect, ultimately, of population decline. Admittedly, an equally significant problem in those countries, which have seen a large reduction in fertility over recent years, will be the economic and social implications of the ageing of those who were born in the high fertility era, owing to the resulting rapidly increasing proportion of the population in the older age groups. None the less, at some point, concern is likely to be expressed, as by Singapore's Prime Minister Goh Chok Tong (1986), that the replacement question is of fundamental importance and is an issue which has to be addressed.

As will be clear from this paper, it is suggested that this subject is best approached from fertility calculated on a cohort basis and it is, of course,

here that problems are likely to arise, since in many countries the data are just not available to enable cohort rates to be calculated easily. In Singapore, the annual number of births by the sex of the child and by the age (and for most years by the race) of the mother are available for the entire period since 1946. With this information, together with annual female population numbers, the calculation of single-age fertility rates for each calendar year is a technically simple (yet tedious) task. Appropriate series of these rates are then summed in order to provide complete cohort fertility rates for those generations of women who have completed their child-bearing, and partial cohort fertility rates for those women below age 44. Where such information is not available, but, say, reasonably reliable period fertility rates in the normal five-year age groupings have been published for a good number of years, these may be interpolated to provide schedules of single-age fertility rates for each calendar year from which partial cohort fertility rates may be derived to form the foundation for the projections outlined here.

Next, it should be pointed out that there is nothing sacrosanct about the normal and log-normal distributions used here to model the total period fertility curve. Whatever distributions are appropriate in practice clearly depends upon their general suitability in a given context for modelling period fertility over the final 10-year age span from 35 to 44. The use here of the normal and log-normal curves was a result not only of their fairly good fit to the Singapore data but also because of their general familiarity and the fact that only three parameters are required for estimation purposes, namely the total period fertility rate and the two parameters of each probability distribution. However, in other contexts different distributions might well be more appropriate.

Also, nothing has been carved in stone regarding the assumptions that have been made regarding the changes in the three parameters over the next 10 years. In particular, there would appear to be little justification for assuming that total period fertility will tend towards the 2.1 replacement level in the longer term. In many ways – although it has comforting implications – this assumption seems to be used by some demographers as a convenient means to avoid the (admittedly disturbing) prospect of ultimate extinction either by overcrowding or disappearance.

Finally, although projections have been made here for only the next 10 cohorts, there is no theoretical objection against projections for a larger number of cohorts. However, the problems with this are firstly that

increased care would be required in choosing the distribution(s) which are suitable for modelling period fertility over a greater range of ages and secondly that a consequence of longer term projections is that the width of the "funnel of doubt" will inevitably expand progressively the further we try to look into the future.

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The Challenge of Urbanization: The World's Largest Cities, Department for Economic and Social Information and Policy Analysis *(New York: United Nations, 1995), 290 p. ST/ESA/SER.A/151, Sales No. E.96.XIII.4*

Published as a contribution to the second United Nations Conference on Human Settlements (Habitat II), which will be held at Istanbul, Turkey, in June 1996, this book focuses on the demographic characteristics, economic structure, available social services and infrastructure of the world's large cities. Included are profiles of a number of cities in the ESCAP region: Bangkok, Beijing, Bombay (recently renamed Mumbai), Calcutta, Colombo, Delhi, Dhaka, Ho Chi Minh City, Hong Kong, Istanbul, Jakarta, Kathmandu, Kuala Lumpur, Metro Manila, Moscow, Osaka, Port Moresby, Pusan, St. Petersburg, Seoul, Shanghai, Singapore, Suva, Sydney, Tehran, Tianjin, Tokyo, Wellington and Yangon.

Review and Appraisal of the World Population Plan of Action: 1994 Report, *Department for Economic and Social Information and Policy Analysis (New York: United Nations, 1995), 150 p. ST/ESA/SER.A/152, Sales No. E.95.XIII.27*

This report presents the findings of the fourth review and appraisal of the World Population Plan of Action, adopted at the World Population Conference held at Bucharest in August 1974. It focuses on 30 selected population issues and provides an overall assessment of implementation of the Plan of Action.

Multiregional Demography, *by Andrei Rogers (Chichester: John Wiley & Sons, 1995), 236 p. plus computer diskette.*

This book is devoted entirely to methodological approaches to that branch of demography which analyses simultaneously the spatial dynamics of a system of several interdependent populations linked by directional migration flows. It was written in recognition of the fact that many of the major problems associated with national population growth and development revolve around the differential impacts of migration between countries, and between the rural-urban, city-suburban, and depressed-expanding subregions of national economies. Intended for mathematically inclined demographers, sociologists, geographers, economists and regional planners, the text includes a general multiregional computer program called SPACE.

Apology

In November 1995, the Editor of the *Asia-Pacific Population Journa* received a letter of complaint from Dr. Karen Hardee, Deputy Director Service Delivery Research Division, Family Health International, drawing our attention to an article published in vol. 9, No. 4 of the *Journal*. The article in question is entitled "Problems and Prospects of Implants as a Contraceptive Method in Bangladesh", co-authored by M. Mujibur Rahman, M. Nurul Islam, Md. Azizul Haque and G. M. Kamal. Her criticism is that the article was drawn almost entirely from the report entitled *The Quality of NORPLANT Services in Bangladesh* co-authored by Ghulam Mustafa Kamal, Karen Hardee-Cleaveland and Barkat-e-Khuda; the latter report was published on 31 December 1991 by the Associates for Community and Population Research. She pointed out that the authors of the *Journal* article, who also included the principal author of the 1991 NORPLANT study, namely the late G.M. Kamal, did not cite the source of their data nor the original study from which most of their material was drawn.

After the Editor brought this matter to the attention of the principal author of the *Journal* article, Prof. Rahman explained the background to the situation and the details of co-authorship of the *Journal* article with Dr. Kamal and another researcher who also contributed to the original NORPLANT study. In acknowledging the complications that have been caused by publication of the article, he requested us to extend his personal apologies to Dr. Hardee and Dr. Barkat-e-Khuda as well as to the management and staff of the *Journal*.

Purpose

The quarterly *Asia-Pacific Population Journal* is a periodical produced by the Population Division of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) with support from ESCAP and the United Nations Population Fund (UNFPA).

Its purpose is to provide a medium for the international exchange of knowledge, experience, ideas, technical information and data on all aspects of the field of population in order to assist developing countries in the region to improve the utilization of data and information.

Original contributions are invited, especially papers by authors from or familiar with the Asia-Pacific region. Ideally those papers will discuss the policy implications of population issues and solutions to problems and will report on experiences from which others may benefit.

Note to contributors

All material submitted for the consideration of the Editorial Board for publication should be in the English language. Ideally, the paper will be supplied in diskette form (5¼ inch) prepared in one of the major word-processing programs. A printed copy is also acceptable: typewritten in double or triple spacing on one side only of white paper (measuring approximately 8¼ x 11¾ inches or 21 x 30 cm). The margins should be generous, at least 3 cm (roughly 1 inch) wide, preferably more for the left-hand margin. Manuscripts should include a short abstract (100-200 words) of the issues addressed and the most important findings.

A complete list of references arranged alphabetically by author should also be included at the end of the manuscript. Please refer to examples in any issue of the *Journal*. Figures and tables should be clearly drawn/typed, each on separate sheets, if not contained in a separate diskette file.

Manuscripts are accepted on the understanding that they are subject to editorial revision. Contributors should indicate in an accompanying statement or letter that the material has not previously been published or submitted for publication elsewhere.

A brief introduction about the author (title and affiliations etc.) should also be included.

Because all manuscripts will be refereed by professionals in the field, the author'(s) name(s) or other identifying information should be placed on the title page only, in order to preserve anonymity.

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Readers of the *Journal* are invited to suggest topics for future coverage and to comment on the articles already published herein. Correspondence should be addressed to:

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